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Contents.

	PAGE
Notes and Comments	107
Pouring Castings without Feeding Heads	108
Tungsten and its Compounds	109
The Erosion of Bronze Propellers	110
Electrical Melting in Revolving Moulds	111
Impressions of American Foundries	113
Industrial Conditions in Spain	115
Institute of British Foundrymen	115
Gas-Fired Annealing Furnace	116
The Heat-Treatment of Stainless Steel	118
Foundry Pits	119
An Oil-Fired Annealing Furnace	120
Table Talk	121
Iron and Steel Markets	122
Company News	124
Personal	124
Gazette	124

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NOTES AND COMMENTS.

The Value of the Weighing Machine.

There are many enlightened foundrymen who are looking forward to the day when all pig-iron will be bought by brand *and analysis*, but their position is being rendered more difficult by the action of some of their confrères, who are retarding progress by not utilising existing means for demonstrating the disabilities of the sand-cast pig-iron bought solely by brand. We recently inspected a foundry which was modern as regards lay-out and means of transport, but who assured us that no benefit was to be derived from weighing or recording the cupola charges. They had undertaken a series of tests for the establishment of furnace losses, and stated that the extra labour cost involved easily counterbalanced the benefits derived from the weighing of cupola charges. We fail to see to what good application the melting losses can be put without a definite knowledge of the weight of material put through the cupola each run.

An impression was given that the cupola man was something in the nature of a superman, who glanced round the foundry, noted the work to be cast, and arranged his mixtures—by eye—accordingly. We put it to foundrymen, similarly situated, that the super-cupola-man may become ill, or his worth may be such that another job may offer an increased attraction, which would leave his late employers in the position of having to find another superman, or trust to his assistant. If a system of weighing charges had been long established, together with a record of the boxes cast each day, then any mixture which had given satisfaction or failed, could be imitated or avoided.

It seems almost inconceivable that in these enlightened days that the value of the weighing machine is not yet appreciated, and we can only hope that the foundry in question is an exception, and in no way represents typical British practice.

Apart from the ability to reproduce or avoid certain mixtures, there are other important considerations, such as the formation of a base upon which to build up the mixing of charges by analysis, the creation of data for the investigation of metallurgical casualties, and the establishment of a case for the introduction of machine-cast pig-iron, with its attendant freight, fuel, and flux economies.

Since the value of the weighing machine does not seem to be universally appreciated, we make no apologies for summarising the advantages of machine-cast pig-iron, which is one of its natural corollaries. In the first place, the foundry does not have to pay for sand invoiced as pig-iron, or for its transport. The second is a fuel economy, as the sand adhering to pig is an effective insulator, and, apart from the heat units required for this, additional calories are required for causing the sand to combine with the lime to form a fluid slag. Another economy is the decreased amount of lime required to be used for the purpose just cited.

The introduction of machine-cast pig would mean the lessening of the sphere of usefulness of the super-cupola-man, but, if the weighing machine has been thoroughly ingrained into the cupola practice, the arrival of familiar brands "undressed" would only mean that a little less had to be used to fill satisfactorily its former rôle.

Stainless Steel.

Though stainless steel, the invention of Mr. Harry Brearley, of Sheffield, has been on the market some eight or nine years, its application is not yet really appreciated, and we doubt if its metallurgical constitution is generally understood. A Paper on this subject, by Mr. Elwood Haynes, was recently presented before the American Iron and Steel Institute, and was given in abstract in the June issue of the JOURNAL. To some of his statements, however, we cannot subscribe, as they are vastly different from current British practice. For example, he gives the carbon range as being from 0.40 to 0.80 per cent., whereas the British specification calls for 0.30 per cent. for table blades and considerably lower, should edge be of secondary importance to the oxidation resisting property. Most of Mr. Haynes' conclusions were confirmed during the discussion by Mr. John L. Cox, which is abstracted on page 118. Mr. Cox gave as his experience that the higher the carbon in stainless steel the better the rust-resisting properties. This is contrary to our experience, but if it should be proved correct it would bring about an enormous reduction in the cost price, since, should steel containing 0.80 per cent. of carbon be found to be satisfactory, it would allow of the use of the carburised and very much cheaper varieties of ferro-chrome.

Many American steels carry a higher carbon content than the corresponding British steels, and no doubt successfully; for instance, rails and high-speed steel, but, for progress in the production of stainless steel, we would advise research in the opposite direction, *id est*, a carbon content still lower than that generally used.

Pouring Castings without Feeding Heads.

By E. Ronceray.

I have been more than pleased to see the interest which has been raised by British foundrymen in my article which appeared recently in the "Fonderie Moderne," and which has been translated into English by courtesy of Messrs. Croydon Foundry, and published in THE FOUNDRY TRADE JOURNAL of July 7.

It was to promote such interest that I decided in the first case to publish my experiments in the French journal "Fonderie Moderne," but I wish to make it perfectly clear that my experiments are not yet completed.

Unfortunately, owing in the first case to one or two mistakes in the printing of the French article, and further to the almost unavoidable translation mistakes, my ideas were made more difficult to follow by average foundrymen.

In order that there shall be no misunderstanding arising from translation difficulties, I would confirm the editorial note that "runners" as used in the text was meant to imply "risers" or "feeding heads."

I suggest the following as being more correct interpretations of the French:—Col. 1, page 3 July 7 issue of the Journal: (a) "cope" should read "check"; (b) "choke" should read "scab"; (c) "narrow jet" should read "small bottom runner." Col. 2, page 1: (d) "hot casting" should read "hot metal." Page 6, col. 1, the French word "évents" has been translated as "vents" instead of risers," and "métal épuré" as "refined" instead of "filtrated metal."

The results obtained by Mr. Harold Measures are to a great extent a confirmation of my views. I said plainly in my article that the methods adopted did not apply to massive castings as shown on Fig. 1 or to "jets," that is to say, long castings of plain and uniform section, as in Figs. 3, 4 and 5, so that really Mr. Harold Measures' experiments are a confirmation of what I stated in the first case, and it is quite natural that Mr. Harold Measures has obtained the same results as I.

With regard to Fig 2, this was a success, and it is yet another confimation of my point. The difficulties met by Mr. Harold Measures in pouring this casting bottom upwards undoubtedly came from a faulty core or core venting. There can be no doubt whatsoever that in such a case the venting of the core must be perfect, as the gases have to escape downwards, and their pressure at any point of the mould must be less than the small ferrostatic pressure at the top of the mould, otherwise they will escape through the metal. It may be interesting to readers to know that thousands of semi-steel shells were cast in the way I have illustrated in France with a very small percentage of scrap, and this goes to prove my assertions.

Fig. 6 shown in Mr. Harold Measures' article is hardly corresponding to the conditions mentioned in my original article. To be perfectly frank, it is a very badly designed casting, having large variations in thickness, and the experiments made upon it do not go to prove anything. However, I think that Mr. Harold Measures should cut the casting and endeavour to ascertain if the depressions of Fig. 7 are sound metal. I would like him to examine macroscopically and micrographically these sections and compare them with the section of Fig. 6 under the riser; I shall be more than surprised if the metal was not tougher in Fig 7. than that under the riser on Fig. 6. If this is so, what I said in my original article is proved, and does not call for further discussion.

To sum up the question raised, in the first case it is not as to whether it is possible to make wasters by making unappropriated castings by some way resembling to the method described, but the reason why by this method it is possible to make under certain favourable conditions good castings even better than by the standard methods already adopted by most foundrymen. The interest which I have mentioned at the opening of this reply was raised, I think, because the method I described is entirely out of usual practice, and I think I am right in stating that what is a surprise to most practical men is that under favourable conditions good castings can be produced by these methods. The most useful point to find out is the reason for success in this direction.

It cannot be disputed that the results shown in my original article can be obtained. They are current practice in our own foundry and they have been witnessed by many British foundrymen, and readers may be interested in the reproduced photograph taken by Mr. J. T. Burford, of Messrs. W. and T. Avery, Ltd., Birmingham, who spent several days in our foundry, and who will be able to testify that these accomplishments are actual facts which have certainly reached a step farther than the experimental ones.

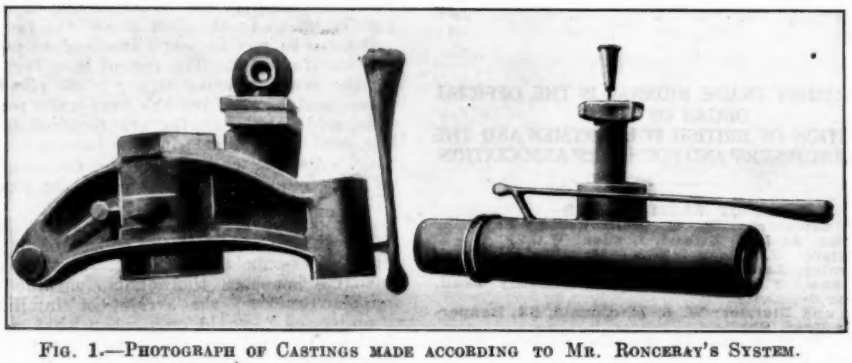


FIG. 1.—PHOTOGRAPH OF CASTINGS MADE ACCORDING TO MR. RONCERAY'S SYSTEM.

I shall be very pleased to receive at our foundry every British foundryman who is interested in this question, and further, I shall be only too pleased if some knowledge is gained by their further experimenting in the same direction. In order to help, although I have not yet been able to draw definite conclusions, I give below a tentative formula which has given good results for castings of the character described in my original article.

This formula is $S = 15 \sqrt{P}$, where S is the section of gate in square millimetres and P the weight in kilogrammes of the part of casting above the gate.

The figure 15 is a constant which may require altering slightly according to different cases, that is to say, the temperature of iron in the foundry, the nature of casting, etc. Generally speaking it has been found satisfactory, but I would state that the iron we are using is very hot, and I consider this absolutely essential for success. English readers are not to suppose that my opinion is that risers must never be used in the future, nor that all work can be made successfully without them. The only point secured up to the present is that *in some cases, under certain circumstances,* risers can be dispensed with even in cases which previously have been considered impossible, with the result that *sounder castings are obtained.*

If the limitations set forth in my article are understood and accepted, it seems evident that something can be gained by setting to work to find

out why it is so and then to try and determine laws which govern the result. So far, it seems evident to me that when the following conditions are met with, no risers are needed:—(*a*) When the nature of the casting is such that the gating and cooling can be arranged so that solidification takes place at the same time throughout the casting. (*b*) That there will be no swelling of the sand, or if there is, it will not continue after pouring is completed.

I am more than surprised to see that Mr. Harold Measures considers that skimming gates are too costly for everyday work. I should just like to point out to Mr. Harold Measures that skimming gates are not more costly than ordinary hand-cut gates. *They are essential to sound casting.* Slag must be prevented by some means or other from going into the casting. The risers used by Mr. Harold Measures on the casting shown in Fig. 1 of his article serve to no other purpose than to collect slag, because the riser of 3 in. or 5 in. is of very little use for feeding a 14-in. thick casting.

Before concluding this reply, I feel that I must in justice to my Company refer to the letter publishd by Mr. George Hall, Mr. Harold Measures' Foundry Manager, in the July 21 issue of the FOUNDRY TRADE JOURNAL.

I take very strong exception to the assertion of Mr. George Hall when he states that "the only safe method for dispensing with vents is by using a jolt-ram moulding-machine." This is absolutely a contradiction with actual practice and facts, and I would like to point out to Mr. George Hall that fact is a very stubborn thing and cannot be got over. If Mr. George Hall is willing to visit our Foundry, I will show him 95 per cent. or more of our moulds with no venting, some hand-rammed but the majority are hydraulically squeezed. Venting has never done any harm and it may be used freely, even when it is not needed. We, ourselves, do away with it altogether except in very rare cases, because it takes time and it has been proved absolutely unnecessary under the conditions which prevail in our foundry, namely, permeable sand, systematically treated to that end, and the absolute prohibition of the peg-rammer.

It must be remembered that preconceived opinions and ideas are not favourable conditions for conducting experiments. Facts must be either accepted or controlled, so that one may be able to work in order to find out the reasons and not lose time to controvert proved facts.

I shall be pleased to go further into this matter with Mr. Harold Measures and Mr. George Hall, or any other British foundryman who is interested in the discussion.

The Institute of Metals.

In accordance with previous announcements, the autumn meeting of the Institute of Metals will be held in Birmingham on September 21, 22 and 23. An influential Reception Committee has been formed to carry out the necessary arrangements.

Amongst the works to be visited are the following:—Alldays & Onions, Limited, Small Heath; W. & T. Avery, Limited, Soho Works; Bellis & Morcom, Limited, Ladywood; Birmingham Small Arms Company, Limited, Small Heath; Earle, Bourne & Company, Limited, Heath Street, South; Elkington & Company, Limited, Newhall Street; Elliott's Metal Company, Limited, Selly Oak; Allen Everitt & Sons, Limited, Smethwick; Kynoch, Limited, Witton; Metropolitan Carriage, Wagon & Finance Company, Limited, Saltley; Muntz's Metal Company, Limited, French Walls; Tangye's, Limited, Cornwall Works; H. Wiggin & Company, Limited, Wiggin Street; Wolseley Motors, Limited, Adderley Park.

In view of an expected considerable accession of new members in connection with the Birmingham meeting, a special Council meeting is being held in London on September 7, for the purpose of considering applications for membership. All applicants for membership whose forms are in the Secretary's hands before noon on September 7 will be entitled to take part in all the proceedings in connection with the Birmingham meeting.

Members are asked by the Council to be good enough to convey this information to any of their friends who may be eligible for membership of the Institute, or to send the addresses of such friends to the Secretary. The new list of members is available upon request being made.

Tungsten and its Compounds.*

Moissan succeeded in melting tungsten in his electric furnace, but in extremely small quantities only and at the expenditure of considerable energy. Hugo Lohmann reports in "Electrochemisches Zeitung," vol. 26, pp. 29-33, that he has been able to make comparatively large quantities of the crude metal and to obtain therefrom a thoroughly fused carbide in a specially designed furnace. The latter was of the arc type, but was constructed in such a manner that the principal disadvantages of this kind of furnace—viz., the smallness of the source of heat and the space within which it can prevail—are eliminated. It was possible to melt 5 kg., or 12 lbs., of amorphous tungsten within fifteen minutes in this furnace. The current consumption is very low. Besides the carbide of tungsten, carbides of titanium, vanadium, zirconium, silicon, boron and uranium were obtained as well.

The hardness of tungstic carbide is 9.8 on Moh's scale. This substance was produced in large quantities and was used with great success to replace the industrial diamond, bort, in all its applications. By melting the carbide it was found that it could be produced in a strong, compact state, so that it could be employed in making dies for wire-drawing machines, in fabricating cutting tools of all sorts, boring apparatus, etc. There appear to be important economic as well as technical advantages in favour of the carbide.

The melting of tungsten and the making of castings, forgings, etc., with the metal have rendered it usable for many purposes for which it could not be used hitherto. It was found that high-speed cutting tools made from tungsten gave very remarkable results in their durability and the thickness of the cut. Any tool or machine part that must stand up against extreme wear and exceedingly high temperatures caused by frictional resistance or otherwise has been improved very greatly by being made from the pure fused tungsten metal.

The author has prepared molten uranium at a temperature of 3,500 deg. C. in large quantities. He has used the metal in making the target in X-Ray tubes and found that the results corroborated the theory that the higher the molecular weight of the target metal the more effective the X-Ray apparatus. He also used the metal in making the contact points for the spark-plugs of gas engines, and instead of platinum for the contact wire in incandescent lights.

The British Cast Iron Research Association.

It is gratifying to know that a large number of ironfounders and users of castings from all over the country have joined the Cast Iron Research Association. Several of them have sent in some very important problems for investigation, which are now being taken in hand. These problems are of such a nature that the result of their investigation will have far-reaching effects upon foundry procedure, but which will, of course, be only supplied to those foundries who have had the foresight to become members of the Association. It is anticipated that the investigation of one of the problems sent in by a foundry will remove a very great casting trouble common to nearly all foundries. The investigation of the problems surrounding foundry pig-iron is also being commenced at once, and it is a noteworthy fact that this is having the warm support of the pig-iron masters generally, so that this vexed question is in sight of being settled.

Owing to the urgency of the work to be carried out the Council have appointed Mr. J. E. Fletcher, M.I.M.E., Dudley, as acting Director of Research until the new Director takes up the work. Mr. Fletcher's appointment has been approved by the Department of Scientific and Industrial Research. The Council are very fortunate in being able to obtain the services of an expert of Mr. Fletcher's standing and one who is so well acquainted with foundry work generally.

* Abstracted from "Chemical and Metallurgical Engineering."

XUM

The Erosion of Bronze Propellers.*

By O. Silberrad.

Author's reply to discussion.

In reply to the written contribution to the discussion on "The Erosion of Bronze Propellers,"† Dr. Silberrad wrote that he entirely agreed with Colonel N. Belaiew's observations; indeed, he had obtained a good deal of evidence that the structure of the metal was a valuable guide to its capacity to withstand erosion of the type met with in guns. It was, he agreed, complicated by the influence of heat, and the differences in the capacity to resist erosion in different steels seemed to be traceable rather to variations in the recalescence points of steels of different structure than to be directly dependent on the structure itself.

He felt obliged to take exception to Mr. Ramsay's comments respecting the late Sir William Ramsay. Sir William's conclusions had been, as far as Dr. Silberrad was aware, entirely drawn from first-hand observations; indeed, it would appear that Sir William had materially assisted in the solution of the problem by pointing out that electrons flowing from the zinc plates attached to the ship would protect both stressed and unstressed portions of the bronze propellers, and that consequently any possible differences in potential that might be set up by such stresses could hardly, as Mr. Ramsay suggested, be seriously regarded as the cause of the extensive deterioration under consideration. As to the late Sir William Ramsay's observation respecting the success and universal adoption of alloys of essentially β structure, this was common knowledge at that date; indeed, statistics showed that not only had the majority of the high-speed ships built since 1909 been fitted with propellers of this type of alloy, but also that many of the more important vessels launched prior to the discovery had been refitted with propellers of the new alloy. Thus at the date of Sir William's letter one firm alone had supplied sets of propellers of this new alloy for no less than 18 British battleships and cruisers, 16 destroyers, torpedo boats, etc., and 16 liners, including such well-known vessels as H.M.S. "Thunderer," s.s. "Mauretania," "Lusitania," "La France," "Imperator," "Carmania," "Aquitania," etc. Since that date almost every battleship, destroyer, and fast liner, indeed practically every high-speed vessel throughout the world, had been fitted with propellers cast of this type of alloy.

With reference to Mr. Ramsay's assumption that the word "erosion" had been used only to refer to the subsequent washing away of damaged metal, Dr. Silberrad desired to remove any ambiguity that his paper might have left on this score; throughout the word "erosion" had been used to indicate mechanical wearing away (as distinguished from corrosion or chemical dissolving away) and to embrace all the mechanical operations involved, *i.e.*, the water-hammer action which pounded and crushed the metal, and also the wash and frictional rub of the rushing water which obviously was the operative cause in subsequently washing away metal so damaged, in a precisely similar manner that frost followed by rain form the combined operative agents in the erosion of exposed rocks. Indeed so far back as January, 1912, he (Dr. Silberrad) had pointed out not only that the deterioration was purely mechanical and therefore properly termed erosion and not corrosion, but also that it was brought about by the action of water broken by intervening evacuated spaces or vacuum bubbles combined with the frictional rub of said water.

Mr. Ramsay's experiments with jets which formed the negative and the metal (brass) the positive of the circuit were certainly interesting, but appeared scarcely relevant, as they took no account of the fact that the propeller of a ship was in direct metallic contact with the large zinc protecting plates attached to some adjacent part of the vessel, the presence of which obviously rendered it impossible for such a condition to exist in practice.

Dr. Silberrad agreed that his own experiments on the corroding action of sea water on stressed and unstressed metal did show a slightly greater corrosion in the case of stressed than of unstressed metal, nevertheless the increase was very small—about 0.0000018 cm. per year in depth; further, it should be observed that the metal in these experiments had not been protected by contact with zinc plates, as in the ship, which zinc would, as already pointed out by the late Sir William Ramsay, prevent the solution or corrosion of both stressed and unstressed bronze alike. That propellers working under great strain might be more subject to erosion than others less strained appeared likely, for it was reasonable to assume that metal already severely strained should be more readily disintegrated by the hammering effect of the collapsing bubbles than metal not so strained; but here again the effect was purely mechanical.

As regards the presence of distorted crystals being evidence of the mechanical nature of the deterioration, Dr. Silberrad agreed that this alone could not be regarded as an absolutely conclusive proof; but, taken in conjunction with all the evidence, he could not help feeling that anyone who read the paper with an open mind must be fully convinced that the deterioration of propellers was due to erosion, *i.e.*, to mechanical causes, and to causes now so well understood that it was possible to classify, produce, and remedy erosion at will, and by the help of Mr. S. S. Cook's admirable treatise on the collapse of water cavities, even to calculate the operative pressure which constituted the chief factor in the preliminary stages

* Extracted from the Journal of the Society of Chemical Industry.

† See "Foundry Trade Journal," Vol. 23, page 277.

DEFECTS IN CASTINGS RESULTING FROM THE USE OF TALC.—According to "La Fonderie Moderne," it frequently happens that moulders neglect to brush off or blow away the excess of talc used on the surfaces of both dry and green sand moulds. Talc is of a light and fluid calcareous nature at low temperatures. When the metal is teemed into the moulds, the talc appears on the surface of the castings or in places where the risers have caused a circulation of air, or caught by the stream of metal. These faults show themselves as holes or blotches, and are often ascribed by foundrymen to bad metal, boiling up or moulding faults. The powder, of which details were given on page 474 of Vol. 23, and which consists of wood ash or spoilt flour, prevents this type of defect. Many soft iron moulders use talc for powdering the moulds and for replacing blacking or graphite, used for the purpose of imparting a good clear surface to the casting. But the above-mentioned defects are usually present on the surface of the castings and it is preferable to use good graphite, or if the work necessitates the use of talc, the smallest possible quantity should be employed.

VICTORIAN GOVERNMENT RAILWAYS REQUIREMENTS.—His Majesty's Senior Trade Commissioner in Australia has forwarded copies of specifications, conditions, and forms of tender in connection with calls for tenders by the Victorian Government Railways, for the supply and delivery of:—(1) 16 sets air brake equipment as specified, or alternatively 16 sets air brake equipment, complete as specified by tenderer, required for Electric Street Railways in Melbourne suburbs. Contract No. 34198. (2) Hydraulic pig iron breaker, including tools, gears, accessories and spares. Contract No. 34191. Sealed tenders on the proper forms will be received by the Victorian Railway Commissioners, Spencer Street, Melbourne, up to 7th September in the case of No. 1, and up to 14th September in the case of No. 2. The tenders must be accompanied by a preliminary deposit of ½ per cent. of the total amount of the offer. Local representation is essential, and as the time for the receipt of tenders is limited, it will be necessary for firms tendering to instruct their local agents by cable.

Copies of the specifications in connection with the above tenders may be consulted by United Kingdom firms interested at the Department of Overseas Trade (Room 59), 35, Old Queen Street, Westminster, London, S.W.1.

Electrical Melting in Revolving Moulds.*

Developments of a revolutionary character in the centrifugal casting of pipe have resulted from investigations carried on for a considerable period by Leon Cammen, Cammen Laboratories, 42, West Thirty-ninth Street, New York, and which are covered by patents just issued to him. By Mr. Cammen's process, the metal is melted electrically in the same mould in which it is cast. Castings have been produced successfully by the new method at the Cammen Laboratories, and the process has been demonstrated commercially. In discussing the field for pipe produced centrifugally by his method, Mr. Cammen has set forth his expectations of the large extent to which his process will be employed for producing steel pipe.

According to the inventor pure aluminium does not cast well, but recently some aluminium tubing was produced by the centrifugal method. The resulting product was of exceptional quality. It had no imperfection, inside or out. By the centrifugal process, tubing will be produced commercially from a host of metals and alloys never before regarded as applicable to production of this product.

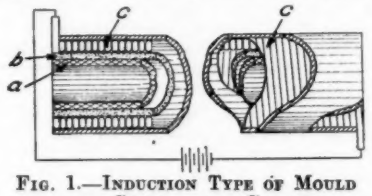


FIG. 1.—INDUCTION TYPE OF MOULD FOR THE CENTRIFUGAL CASTING OF TURBINES.

In commenting on the status of the art, Mr. Cammen stated that the process of casting centrifugally is old, having been employed extensively for producing articles of wax, chocolate, lead, etc., but that its application to metals having a high melting point is a development of practically the past eight years. Tests of the cast-iron pipe produced by the de Lavaud centrifugal process, of the centrifugally cast piston rings and engine cylinder linings produced by the Stokes Castings, Limited, Mansfield, England, of the centrifugally cast copper bands produced by the George C. Clark Metal Products Company, Detroit, and of the centrifugally cast tubes made by W. H. Millspaugh, Sandusky, O., prove conclusively that the centrifugal method of casting is capable of producing articles of high excellence. The methods heretofore employed, according to the inventor, are not suitable to quantity production, and do not admit of a full realisation of the potentialities of centrifugal casting as it has been developed. The particular feature that makes the Cammen process of centrifugal tube casting commercial is that, instead of melting the metal outside and pouring it into the mould, the metal is melted electrically in the mould and then subjected to the spinning process. In other words, in this process, each mould is a little electric furnace in which the metal first is melted and then spun into a tube. Where the metal is melted in an outside furnace, the main difficulty in making tubular goods lies in the tendency of the metal to chill, especially when it strikes the comparatively cool mould. In order to obviate this difficulty the mould must be preheated. This is accomplished electrically in the Cammen process in the same way as the melting of the metal is accomplished. The equipment employed in this process is designed not only to afford thorough control of the temperatures, but also of the composition of the metal. In fact, the entire process has been worked out to operate automatically.

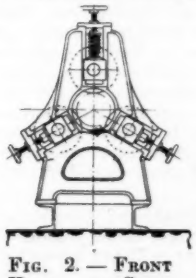


FIG. 2. — FRONT VIEW OF SPINNING BENCH.

FIG. 3.—CROSS-SECTIONAL VIEW OF THE SHEATH FOR ENCLOSING THE MOULDS.

The type of furnace on which the centrifugal casting mould is patterned in the Cammen process varies the condition in each case. For small steel tubing, up to and including 6 in. in diameter, the induction type, in particular high-frequency, has been found preferable. For larger sizes, it appears better to melt the metal and heat the mould by passing a resistance current through it and the lining. The selection of the type is a matter of judgment in each particular case. A mould of the induction type is illustrated in Fig. 1. It consists essentially of a refractory tube, *B*, surrounded by a copper tube spiral, *C*, through which is sent a high-frequency current of approximately 6,000 volts at 11,000 cycles. A constant stream of cold water is sent through the tube in order that the exterior of the mould may be kept cool. When it is necessary to protect the refractory from the action of hot metal, an auxiliary lining, *A*, is added. In order to enable the mould to withstand the stresses due to spinning, and to protect the copper tubing from possible injury in the spinning bench, the entire mould is enclosed in a sheath, illustrated in cross-section in Fig. 3. The design of the moulds embodying the resistance principle is illustrated in Fig. 4.

FIG. 4.—RESISTANCE TYPE OF MOULD.

Metal is charged into the mould in the form of a cold bar of the desired analysis and weight. It is contemplated that when the process is adapted to a tonnage production basis, hot bars will be charged immediately after they have been cast from open-hearth, crucible, or electric furnaces, thus retaining their original heat. Where a cold bar is charged, the mould is placed on a rack and the electric current applied until the metal has been thoroughly liquefied. During this stage the mould is turned continuously in order that the metal, as it softens, may not have a prolonged contact with any portion of the lining, as this would result in damage to the mould.

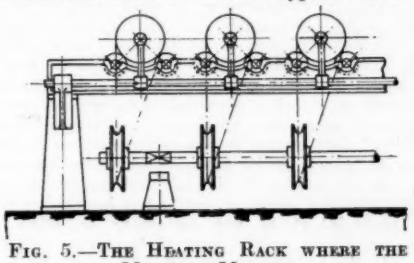


FIG. 5.—THE HEATING RACK WHERE THE METAL IS MELTED.

From the rack the mould is transferred to the spinning bench shown in Fig. 2. The latter is of substantial construction and must be erected on a solid foundation, since a great amount of vibration would prevent the production of perfect tubes. The bench is of heavy steel "A"-frames spaced 2 to 3 ft. from each other. Through these extend three lengths of steel shafting, 2 to 3 in. in diameter. The mould is placed in the spinning bench by lifting the top shaft, and the mould is spun by contact with friction wheels mounted on the shafts on 8-in. centres. The shafts may be adjusted by means of set screws located in the "A"-frames. Great care is observed in keeping the shafts perfectly aligned, since, if the axis of the mould does not coincide exactly with the

Extracted from "Iron Trade Review."

axis of rotation, the castings will be thicker on one side than on the other.

The speed of spinning varies from each metal and each size of tubing, and must be determined carefully. Excessive speed in spinning alloys of metals having widely different specific weights may lead to segregation. In the case of bronzes, for instance, it would result in a higher tin content near the centre than at the periphery. The length of spinning time also is dependent on the kind of metal and the size of the tubing.

The time of spinning has an important bearing on the lay-out of the process. For instance, if it requires a total of four minutes to transfer a mould from the rack to the spinning bench, to spin it and to withdraw it in order to make room for another mould, the rack must have capacity for supplying 15 moulds an hour. If it requires one hour to bring the cold metal to a liquid state, there, the rack shown in Fig. 5 must have capacity for 15 moulds.

The principal investment in producing tubing by the centrifugal method is in connection with the equipment for generating electric current for melting the metal. It is calculated that to melt one pound of steel, about 1 kilowatt per hour is required, starting with cold metal. For a 10-foot tube, with an internal diameter of 2½ in. and an outside diameter of 3 in., weighing about 7 lbs. per foot, generating equipment of 70 kilowatts is required. The size of the total electric generating equipment, therefore, is determined by the amount of current that will be consumed at one time, and this factor is directly related to the capacity of heating rack, and, in turn, to the capacity of the spinning bench. Incidentally, Mr. Cammen estimates that the total cost of producing steel tubing by his process now is 3.25 pence per pound at the most, not including selling expenses.

The selection of materials for the linings of the mould is a matter of great importance. Where the resistance principle of heating is employed, it is necessary to use a conducting material, like graphite, for the lining. Electric current is applied to the conducting lining which thus may be brought to any desired temperature. Where the metal attacks the lining, as when graphite is used in casting steel-tubing, an auxiliary lining is provided for protective purposes. For instance, zirconium oxide wash may be used over a graphite base. A careful investigation has shown that when the induction principle is employed, a properly prepared lining made of zirconium oxide, with or without binders, stands up under repeated meltings, and gives a smooth surface not subject to excessive spalling. The inner and outer circumference of each section of the lining must be strictly concentric, as otherwise the castings will not be of uniform cross-section. Such a strict concentricity cannot be secured in the kiln. Therefore, in making the linings, it is necessary to select a material that can be reamed or ground to exact dimensions. Graphite can be machined and zirconium oxide ground. Another material which is suitable when the induction principle is employed, is calcined magnesia with which a binder, such as tar, must be used. With this material it is not necessary to bake the lining in a kiln as the heat of the first melt supplies all the baking necessary. Thus the calcined magnesia may be applied in the mould and distributed by spinning the mould for a few minutes. Where an auxiliary lining is applied, such as a zirconium wash over a graphite base, the auxiliary surface may be spread by spinning the mould.

A device has been developed for cleaning off the inner surface of the tubes, since it is on the inner surface that the impurities and imperfections appear in a centrifugal casting. This device, in effect, is a lathe with a great distance between centres. The tube is held in what corresponds to the tool holder, and the tool itself is somewhat like a shaper tool. It is mounted on a large bar which is drawn through the tube at high speed, thus cleaning the inner surface in a small amount of time.

Mr. Cammen has obtained an option on the plant of the Metal Alloys Company, Elizabeth, N.J., and, with his associates, will employ his process there for manufacturing aluminium bronze tubes of all diameters.

Mining and Iron Industries in Yugo-Slavia.

Information regarding the mining and metallurgical industries in the Kingdom of the Serbs, Croats and Slovenes (or Yugo-Slavia) is contained in a recent report compiled by Capt. E. Murray Harvey, O.B.E., M.C. (Commercial Secretary to the British Legation at Belgrade), and issued by the Department of Overseas Trade.

The mining industry is as yet very little developed. In Serbia the constant state of warfare, precluding the investment of capital, has left the mineral wealth of the country for the most part unexplored, and therefore unexploited. The absence of technical men of practical experience has resulted in much waste of time and money in prospecting territories which are of little economic value, while the granting of extremely large concessions with exclusive rights of search to individuals with very small capital has resulted in many promising territories being closed to people actively interested in mining. In this respect, however, there is prospect of the laws being amended and the concessions held by individuals limited. In Croatia, Slovenia and Bosnia, the rival claims of Austria and Hungary to the development of State mining concessions have in the past adversely affected the development of mining industry in these provinces.

The principal iron deposits are the mines of Ljubija, in Bosnia, developed by the Austrian military authorities during the war; those of Vares, Bosnia, mines and ironworks; and those of Zenica, ironworks only. These works are on a primitive scale, and the production confined to pig-iron and small castings.

The furnaces in Bosnia, which are the property of the State, have not been worked at anything like full pressure, owing to strikes and the lack of coal. In Slovenia, the works at Jesenica have also had troubles. The engineering workshops, however, had a good year in 1920, as they were concerned with the repair of factories and plant which had been damaged during the war.

In Serbia, where it has not yet been possible to re-constitute the large works which have been damaged, some small foundries and engineering works have been established. This branch of industry could be greatly expanded: railway and other construction require great quantities of material, such as rails, wagons, locomotives, etc., and agricultural implements are also in great demand, which it is thought could well be manufactured in the country if the large deposits of iron ore were properly exploited.

There are large deposits of lignite, but practically no coking coal. The following figures for the coal and lignite production in 1920 are obtained from the Ministry of Mines and Forests:—Serbia, 341,950 tons; Croatia and Slavonia, 387,390 tons: Slovenia, 1,193,874 tons; Bosnia and Herzegovinia, 826,669; Pecs (Hungarian territory at present occupied by the Yugoslavs pending ratification of the Treaty of Peace with Hungary), 473,850 tons; total, 3,223,733 tons.

Chrome ore occurs in Serbia and Bosnia, and also in Macedonia, but amongst other reasons the high freight rates at present will not permit the active exploitation of these deposits.

Manganese occurs in low-grade deposits in Serbia, principally as manganiferous iron ore, but the grade is not high enough to allow of exportation. True manganese ore has been worked near Sarajevo, in Bosnia, for upwards of thirty years.

Important mines for lead and zinc ore exist in Northern Slovenia. Lead and zinc ore has been mined in numerous places in Serbia and Bosnia, but very little work is being done at present.

Large deposits of bauxite occur in Dalmatia, and should in future be developed. There are no aluminium works, and such ore as has been mined is exported to Germany, Italy or Austria.

The largest copper mine is that of Bor, owned by a French group, the pre-war output of which was 7,000 tons of blister copper. The output is now, from various causes, much less. There are some other quite small propositions which can, however, hardly rank as producing mines.

XUM

Impressions of American Foundries.

At a recent meeting of the Halifax Ironfounders' Association, Mr. Rupert H. Pickles gave a very interesting address on his visit to the Columbus meeting of the American Foundrymen's Association and to several large foundries. In speaking of the Exhibition held in connection with the conference, Mr. Pickles states that it was held in the buildings of the Ohio State Fair. Seven large buildings (75,000 sq. ft. floor space) were grouped together in such a manner as to render it possible to view each in succession, and then go to that section in which was grouped the machinery or supplies desired to be studied in more detail. It is estimated that fully 6,000 people attended, whilst the number of exhibits were 235. There were machines for every conceivable use in a foundry.

Two buildings were given up exclusively for exhibiting sand-blast plants, and there is no doubt but that the exhibits represented the best and most modern equipment for the foundry in all its branches. No machinery operated by hydraulic power were exhibited, whilst 99 per cent. of power machines were operated by compressed air. To take moulding machines first. There were 16 firms showing all types and sizes, ranging from a light press machine to a huge jolt turnover machine, with a capacity of 45 tons. The small machine conspicuously in favour was the jolt-press type, and exceedingly large outputs were claimed from these machines. The favourite large machine was the Herman jolt-turnover type. With one machine by the Berkshire Manufacturing Company the man had only to place on an empty box, turn a tap, and then put the finished mould on the floor in the space of fifteen seconds. In actual foundry practice, one wonders how these machines will stand the test, because we are all well aware of the conditions which exist, not in isolated cases, but in all foundries. One very interesting exhibit was the stand of W. H. Nicholls & Co., as it showed a mould jolted and pressed and the pattern being drawn from the mould without being bolted or clamped in any way to the machine. The pattern clung to the presser head without being clamped in any way, as it was actuated by a small switch, which magnetised the head, and as a result clung to the pattern whilst the table was withdrawn. This company had also a room at the back of their stand in which were shown moving pictures illustrating the machines at work.

Other interesting exhibits were sand-mixing machinery. This equipment has certainly received more attention in the States than in this country, and all kinds of machines were shown including paddle, centrifugal and intensive. Other interesting exhibits were ladles, cranes, cupolas, boxes, pattern-plates in aluminium, indicating meters for recording and measuring the pressure and volume of air delivered to the cupola, fluxes for purifying metal, patterns and wood-working machines, various machine tools, electric and pneumatic riddles, compressors, pneumatic hammers and rammers, grinding machines, tumbling barrels, runways, vibrators, core-making machines, oil-fired and electric furnaces, grab buckets, core oils, sands, coke and metals, chaplets and studs and skim gates, petrol and electric trucks for industrial haulage, crucibles, magnetic separators, steel core-plates, machines for sawing and grinding cores, electric and acetylene welding plants, cleaning stars for tumbling barrels, models and plans for foundries, core ovens and heating and ventilating systems for foundries, conveying machinery for handling sand and boxes, chemical apparatus, goggles, leggings, and gloves, electric hoists, elevator trucks, McLain's system of semi steel, emery wheels, fans and blowers, trolleys, blocks, turntables, safety clothing, hospital equipment, sanitary drinking fountains, washstands

One stand made a special feature of exhibiting what they called Sterling Veterans. They were steel boxes which had been in use five years, which points to the fact that immediately a box becomes damaged, it is cheaper to scrap it and buy a new one rather than spend time repairing it. Wax vents, plumbago, flint, and sand shot were also exhibited.

The first works to be visited was the foundry of the Cincinnati Milling Machine Company. The labour here, as in most places, is mixed, and the coloured men receive the same wages for equal work done. Practically all moulds and cores are made on machines, and most of the labour is unskilled. Their moulding boxes are made exceptionally strong, whilst patterns are either in iron or maple wood. All castings are made of semi-steel, and all cores are inspected before going into the foundry, whilst their table faces are all chilled. On larger castings, gangs of men are at work, one making the bottom parts, another putting in the cores, another making the top parts and closing the mould, whilst another does the pouring. All boxes are dealt with by a night gang, who mix also the sand. In the States, hoists are almost universally used for taking iron and coke on the cupola stage, and it is the common practice to weigh all charges. Some charge by hand, and some mechanically. The molten metal at this foundry is all taken away by electric travelling trucks, some being taken a quarter of a mile away, so the whiteness of the metal as it leaves the cupola can be left to the imagination. A novel feature was employed in the small work foundry. As a moulder completes his mould, he pushes it on to rails at the back, and succeeding moulds push it to the bottom of the incline which saves the necessity of carrying moulds the full length of the floor. By this method, the company claim to have increased the productive capacity of man and machine by 20 per cent. They take a pride in the method in which they store their patterns. For a foundry of this size, an exceedingly large number of patterns are in use; still, the system they adopt is simple and efficient, and no confusion takes place. In the pattern shop they have some wonderful machinery. One machine had a capacity of 20 ft. by 12 ft., and within its capacity a lad can cut and carve them from solid wood any kind of pattern or corebox.

The next works to be visited was the Ford works at Detroit. The machine assembling shops were first visited where everything works as clockwork, and men are kept working on one operation all the year round, whether it be machining or assembling. For instance, one man puts one certain nut in a certain place all the year round, and this is the system on which they work. A car was completely put together in twelve minutes in the presence of the English visitors. It must be very monotonous for the men, but were it not for this system adopted throughout their entire works, Fords would not be turning out 5,000 cars per day

In the foundry the largest casting made is the cylinder, weighing 125 lbs., whilst 1,200 tons of iron are melted every day. As in all the workshops visited, raw materials are brought into the yards and works by rail. All the iron is taken direct from the wagons by means of lifting magnets on to the cupola stage. The foundry is continuously operated on three shifts of eight hours each. Three large travelling derrick-cranes are used to take the iron from the trucks on to the stage, and in addition several hoists are at work for taking the coke and heads and risers on to the stage. Three cupolas, with capacities of 40 tons per hour are always in operation. Blast is delivered at 18-oz. pressure. They have also three cupolas constantly being prepared, which are used on alternate days. The cupolas are charged by hand. The foundry works like clock-work. This is made possible by the repetition nature of the work and also by the system adopted. No one man does two jobs. Their work never varies, and all is so well balanced as to get a complete cycle of operations for one unit without any overlapping. The results are simply stupendous. The total number of castings made in one month and every month is seven millions, and these seven million castings weigh 33,000,000 lbs., an average of 4½ lbs. per casting. The loss in the foundry is only 5 per cent., and the total loss, including all the returns from the machine shop, is 9.8 per cent. Only one class of iron is used for all purposes, and it is a semi-steel mixture containing 8 per cent. steel and 2.8 per cent Si., giving a Brinell hardness test of 200.

XUM

Two men make 550 20 in. × 12 in. boxes, each and every day, and they have to make good all wasters.

A rather novel feature is employed for these boxes. A piece of mechanism, best described as a roundabout, is close to the machines on which the moulder places his completed mould, and as far as the moulder is concerned his work on that mould is finished. This roundabout is always on the move, almost a walking pace, and when at a point nearest the cupola, the moulds are poured by another gang of men. Still travelling a little further, the weights are taken from the boxes, and hung on the roundabout on special pins provided above the boxes. The moulds are then knocked out over a grate and the box put back on the roundabout, so that when the moulder puts on a complete mould, he takes off the empty box. The whole cycle must of necessity be complete or the moulder could not produce the number required from him for the day. When the castings are knocked out they are put on a travelling conveyor, and not handled again until they are dropped into tumbling barrels. The sand drops through grates into the basement, where it is prepared and conveyed into hoppers situated above the machines. This method is adopted with every mould.

The making of the cylinders forms an interesting study. Again gangs are at work on one operation only. The four cylinders are cast *en bloc*, and the production works out at 135 for each three men. Although it is a very intricate casting, and a thin section of metal, they get an average of 2½ tons of castings per moulder. When this is compared with an average in Halifax district of 3½ cwts., is there any wonder at the Americans beating us in the open market? The cylinder moulds are all hand-rammed. They are made on a turnover machine, and the purpose of the machine is for drawing the pattern only, and to save the men from handling it. One gang of men made bottom parts only, and they are then put on a conveyor. Moving along, another gang place the cores, and further on another set put on the top parts. It is then prepared with clamps and runners, and moving nearer the cupola is cast by another gang; and the same operation as previously described for the smaller boxes is then gone through. A novel and interesting feature is that in the position where the cylinder castings are knocked out of the box, a large hood is placed to take away the heat and the fumes. All the cylinder moulds are sprayed with paraffin and plumbago, and are not dried. The core shop is worked in a similar manner. No less than six men take part in the making of half a cylinder core, but the day's output is colossal. The cores are dried in a continuous oven. They are placed, when made, on a conveyor, which travels through a series of ovens and in three-quarters of an hour, their journey is complete and the cores are dry. Other conveyors take them to the position required in the foundry. Blacking is sprayed on the cores before drying and the binders used in their core sand are linseed oil, fish oil, powdered pitch and molasses. All core boxes are of metal and are cleaned with paraffin oil.

Another feature was the method by which the piston rings are made. These are made of cast iron, coming from the same cupolas as other castings. A small motor is used for revolving a pan with a receptacle 4½ in. dia., and 6 in. deep at a speed of 3,000 r.p.m., and whilst travelling at this speed, the molten metal is poured in. The centrifugal force spins the metal around the outside of the pan, and has the effect of closing the grain. Immediately they are cast, the pan is stopped, and the castings knocked out and then placed on a conveyor and dropped into an annealing oven.

In the dressing shop are a large number of tumbling barrels. When the castings are taken out, they are placed on conveyors which convey them right into the machine shop, and are taken off at the point or machine at which they are required. There are over two miles of conveyors, and some castings are to be found on running motor-cars the same day they are cast. The wages paid the men vary from 6 to 8 dollars per day. Every courtesy was extended to us, and we were invited the following day to visit what is said to be the largest foundry in the world. It is on the opposite side of the city, and for extension Fords have not bought 40 yards or 40 acres, but 40 square miles. At the present time, on this land are working blast-furnaces, coke ovens, and rolling mills, whilst almost complete are assembling and machine shops, and the new foundry. The size and extent of the shop is enormous. Travelling in a motor-car at 10 miles per hour, it took ten minutes to cover the length of the shops to be occupied as foundry, machine and assembling shops.

At Buffalo a representative of the E. J. Woodison Company took us to visit the foundry of the Niagara Boiler and Radiator Company, situated at Tonawanda, some 14 miles out of Buffalo. Here, as elsewhere, enormous production was the outstanding feature. The radiators are only 5/32 in. thick when cast, and yet each man turns out one ton of castings per day. Two men on 38-in. 3-column radiators make 120 moulds per day, and two men on 26-in. radiators, two in a box, make 86 moulds per day. Additionally to this, the men pour their own moulds, but do not get up their boxes or prepare their sand, this being done by a night gang. Also all the moulds are hand-rammed, a machine being employed for lifting the mould away from the pattern only. The machine travels along the shop as the moulds are put down, and the sand heap diminishes. All moulds are tilted, and are cast from a runway ½-ton ladle. The moulds are placed three high. A plate is put on the top box and by use of two clamps is held in position, which eliminates the necessity of weights. The boiler sections are made on Herman jolt-turnover machines, which were very extensivly used in the foundries visited. The small castings are made chiefly on press machines, and where made by hand, aluminium pattern plates are used for lightness. The cores are made with extreme rapidity. A short time ago, an English firm was advertising their core oil, and as a selling feature, they illustrated a radiator core which, by the use of their oil, had been made in ten minutes. Here the same core was made in 15 seconds each by two men, and each day they make and place in the stoves 1,200 radiator cores. All the men at these works are paid on the piece work system.

At Rochester, the works of Gleesons who specialise in the manufacture of gear-cutting machines were visited. Here again the great strength of the moulding boxes which are used on the machines was noticeable. The bars for the top parts are jolted and then strickled off about 1 in. above the box edge; a plate is then put on the box and jolted until the plate rests on the box edge. This saves the flat-ramming. A novel feature was employed for stopping the flow of metal at the spout, where, by means of a swivelling arrangement and spring, an office boy can stop, without danger, the flow of the metal. The cupola was the only one seen during the visit that was coupled up to a receiver. This had not a brick and plate on top, as is our usual English practice, but instead had a domed C.I. top of about 1¼-in. metal. A lug was fixed on each side of the receiver, and two were cast in proper position on the top by which it was bolted down. In the centre and on the top a lifting-hook was cast in. The receiver top was taken off each day for cleaning purposes. In this foundry, as in others, the press machine was used for small work, though here, boxes up to 30 in. were used on these machines. Large sand mixing machines were used for both core and facing sands. In the core shop was a small emery wheel and metal saw which appeared to do very useful work. Lifting trucks for conveying all commodities are very extensively used, both here and at all other places visited.

The last foundry visit was to the works of the Landers, Frary and Clark, makers of household goods, at New Britain, Connecticut.

At this foundry, a million meat choppers are made every year. The main body casting contains two cores, and one man makes and casts 270 each and every day. One man makes 900 name plate castings every day. He puts down 225 boxes, with four in each box. Snap flasks are used, the man pouring his own moulds, and preparing his sand. He commences at 7 a.m. and his day's work is complete at 4 p.m. The joint lines of the form for feeding the meat to the chopper are scarcely discernible, and yet one man

makes 1,000 of these every day. The cutter or meat chopper has the runner connected to every tooth, and one man turns out 2,000 castings every day. One of the most interesting products was an ordinary table knife. In America, the handles are a neat design of light cast iron. They are cast twelve in a box. The moulder places the knife blades in position, and makes 2,400 every day. The cores for the meat choppers are also made in the same remarkably quick manner, one man and six girls turning out 4,000 cores every day. The core sand comes down a hopper, is blown into the core box, and then placed on a conveyor, and the girls then strip and clean the box which again works back to the machine. In this foundry, with no castings exceeding 9 lbs. in weight, and with only 32 plate moulders, they cast 35 tons of metal every day.

Industrial Conditions in Spain.

Reports received in the Department of Overseas Trade from the Commercial Secretary to His Majesty's Embassy at Madrid, with regard to openings for machinery in Spain, state that although Spain is primarily an agricultural country the Spanish farmer has not kept pace with the times. The most antiquated methods are still employed. Grain continues to be cut by scythes and threshed by trampling. Wooden hand ploughs are in common use. The change which is inevitably taking place is retarded by ignorance and prejudice. An innovation in one district is slow to react in the next.

In short, the opening in Spain for agricultural machinery is wide, but new business often involves educating the buyer first. The tariff on these goods has been recently raised 50 per cent.

The tractor has not yet established itself definitely in Spain, and the various exhibitions which have been held in the past year or so have not had much apparent success. The public interest has been small, and the sales of machines through the exhibitions are said to have been disappointing. The chief advantage of these shows seems to lie in the extensive press notice they have received. The market for tractors is more of the future than the immediate present, though the time is opportune for manufacturers to lay the foundations of business by making their machines known.

Winnowing and cleaning machinery is made in Spain, though there is certainly a margin for popularising the use of modern machines of which the British manufacturers might take advantage if able to compete in price.

Milling machinery is partly imported and partly manufactured in the country. The demand for wine and cider presses is largely supplied by local production, but there seems to be an opening in the Vigo district. Drilling and threshing machines are not much used. On the other hand, there is a growing foreign trade in small motors for agricultural use. In this the Swiss and Germans are keen competitors.

The trade in non-agricultural machinery other than mining should have received a stimulus from the recent increase in the import duties on manufactured goods, though the duties have also been increased on machinery. The metal working industries have obtained a specially high protection, amounting to between 100 and 250 per cent. As regards screws and screw-nuts, it is true that, hitherto, the demand has been mostly supplied from abroad, and it is to be expected that with the assistance of the duties the home production of these goods will tend to increase.

The Spaniard does not readily renew his machinery, and in the Barcelona district hardly any of the profits made during the war seem to have been invested in new installations, and some of the local textile factories are still using machinery that dates as far back as the year 1880.

The following local trade openings have been reported:—

Barcelona.—Water turbines are likely to be largely required for the numerous power plants which are being put up all over the country. At present this trade is almost wholly in the hands of Swiss and German manufacturers, but it remains to be seen what effect on this demand will follow the Royal Decree of June 14 obliging future holders of water power concessions to use Spanish machinery whenever possible.

Centrifugal pumps are also largely required for irrigation purposes. Light cheap pumps and motors are at present supplied by American, German, Norwegian, and Swiss makers.

Machine tools on a large scale have been supplied by America and Germany, but business is temporarily at a standstill. British firms, though represented on the spot, have been unable to compete, owing to their high prices.

Vigo and Corunna.—Screws and files are in large demand. The Spanish product is of very poor quality.

The British Vice-Consul at Corunna gives a striking illustration of the insidiousness of German methods. When Germans quote prices of their goods to merchants in this district, they add the following clause, "If these prices are found dear, please make us a counter offer."

Castellon.—The Vice-Consul at Castellon states that in his district there is a demand for machine tools not only for metal workers but also for woodworkers. In the carpenter and cabinet making industries much work is done by hand which could with advantage be done by machinery. The manufacture of all sorts of house furniture has developed considerably of late years, and a large export trade has been established. But in order to introduce the machinery, manufacturers must either send travellers who are able to explain the advantages of their machines or they must appoint agents with security of their appointment for a number of years; it is not likely that propaganda confined to the sending of catalogues will lead to business.

Institute of British Foundrymen.

Arrangements for Annual Conference, 1921.

Tuesday, September 13.—General Council Meeting at 7 p.m., Palatine Hotel, Promenade, Blackpool.

Wednesday, September 14. — 10.15 a.m., Welcome by His Worship the Mayor of Blackpool, C. W. Callis, Esq., J.P., at the Lecture Hall, Central Library, Queen Street, Blackpool (by kind permission of the Municipal Authorities). 10.30 a.m., General business meeting, open to Members, Associate Members, and Associates. Election of President, Mr. Oliver Stubbs, M.I.M.E. (Lancashire Branch). Paper: "The Basic Hearth Electric Furnace and Some Problems of Cast Iron." Prepared by George K. Elliott, Esq., of Cincinatti, Ohio, U.S.A. Discussion.

3 p.m.—Civic reception by the Mayor and Corporation in the Town Hall. Ladies invited.

6.30 p.m. — Dinner at the Palatine Hotel. Tickets 10s. 6d. each (exclusive of wines). Morning dress. The accommodation is limited and early application should be made, accompanied by remittance, to the General Secretary, Mr. W. G. Hollinworth, Besemer House, Adelphi, London, W.C.2.

Thursday, September 15.—10.30 a.m., Lecture Hall, Central Library, Queen Street, Blackpool. Paper: "Some Perplexing Foundry Problems," by John Shaw, Esq., Sheffield. Discussion. No arrangements have yet been made for the afternoon.

Friday, September 16.—By kind permission of the directors of Messrs. Vickers, Ltd., a visit will be paid to their Naval Construction Works at Barrow-in-Furness. The following are the provisional arrangements:—9.15 a.m., Leave Blackpool by electric cars for Fleetwood; 10 a.m., leave Fleetwood by special steamer for Barrow; 12 noon, lunch at the Furness Abbey Hotel by the kind invitation of the directors of Messrs. Joseph Stubbs, Ltd., Manchester; 2 p.m., visit to Messrs. Vickers' Works. Return fare (inclusive) Blackpool, Fleetwood and Barrow, 7s. 6d. Applications for tickets to be accompanied by remittance.

Advance copies of the Papers may be obtained upon application to the General Secretary. Members are advised to make early application for rooms on account of the busy season.

Several branches of the Boilermakers' Society on Tyneside have voted against the proposal to amalgamate with the Blacksmiths' Society.

XUM

Gas-Fired Annealing Furnace.

An interesting commercial efficiency test has recently taken place on a new annealing furnace installed at Messrs. Guest, Keen & Nettlefolds, Limited, St. George's Works, Smethwick, by Messrs. Smeeton-Wright Furnaces, Limited, 56, Victoria Street, Westminster, London, S.W.1. The plant is the first of its type to be put under gas in this country, and consists of two self-contained twin-pot rotary flame annealing furnaces designed on the lines laid down and patented by M. A. B. Chantraine, of Marcinelle.

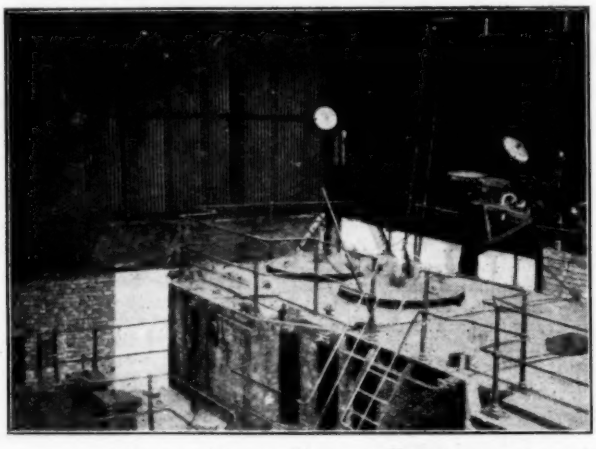
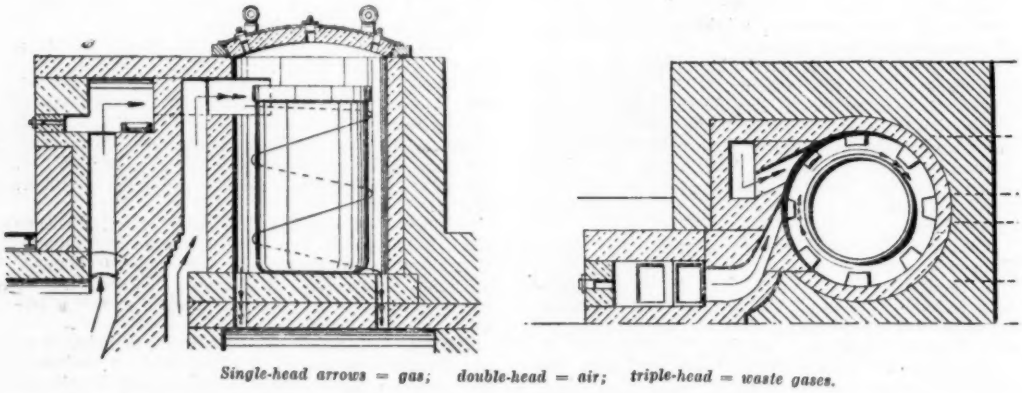


Fig. 1.—General View of Furnace.

The test was officially commenced when the first pot was put into a cell at 11 a.m. on the Tuesday, and proceeded day and night continuously until 6 p.m. on the following Sunday, when the last pot was withdrawn. The duration of the test was thus 127 hours, and during this period 125½ tons of furnace contents were heated to an average temperature of 800 deg. C. with a total consumption of 11,149 lbs. of coal of producer-nut quality. This works out at approximately 88½ lbs. (viz., 3,95 per cent.) of coal per ton of furnace contents. Thus the consumption was well within the 6 per cent. guarantee. The usual figure for annealing rivets or wire in this country is anything from 2½ to 8 cwts. ((viz., 12½ to 40 per cent.) of coal per ton of furnace contents.

The furnaces were specially designed for annealing wire and steel-strip coils, and small materials such as rivets, screws, etc., to be contained in cast-steel pots about 5 ft. 9 in. high by 3 ft. dia. and 1 in. thick, each weighing about 22 cwt., or small canisters 18 in. by 15 in. by 3/16 in. thick. It is usual to fill the heavy pots with wire, strip, or other material weighing from 35 cwt. to 2 tons, making the total charge of pot and material in each pot-hole approximately 3 tons. The weight of the total charge is calculated in relation to the size of the producer and recuperator for a predetermined period of heat-treatment, during which the furnace-contents are heated from cold to about 800 deg. C. in 3½ to 4 hours. If a heavier charge of small materials is filled into the heavy pots, giving a total weight of, say, 4 tons, it requires a longer period of, say, 4½ to 5 hours for a similar heat-treatment.

In Belgium, where a large number of these furnaces are working successfully, small material is always heated in canisters which are contained in a cage so as to get the heat evenly distributed all round the smaller pots. It is inadvisable to charge small close-lying material into large, thick, heavy pots, as the weight is excessive and the time period for perfectly evenly heating throughout is necessarily lengthened beyond the economic limit. Further, it is an unnecessary waste of calories to heat with each charge such heavy thick pots, unless such pots are necessitated by the size of the coils or materials to be heat-treated.



Single-head arrows = gas; double-head = air; triple-head = waste gases.

Fig. 2.—Sectional Views of Annealing Furnace, showing Course of Gas, Air and Waste Gases.

If white annealing of bright materials is required, special lids are made for the furnace, which are constructed to carry a number of long, small-diameter canisters charged through the lids. To the tops of the canisters can be attached a connection supplying town's gas, or other simpler means for obtaining satisfactory bright-annealing can be utilised with success.

Each furnace contains two pot holes or cells 4 ft. 3 in. dia. and 6 ft. deep placed adjacent to each other, and under each cell is built a special high-efficiency Chantraine continuous patent recuperator. A slow-action producer of the Chantraine-Siemens type is built integrally with each furnace, the producer charging-platforms being placed about 5 ft. below the level of the cell

working-platform. Each producer is fitted with two small hoppers placed in the roof, each hopper having a light water-sealed cover to prevent the gas getting at the furnaceman when the hoppers are being charged.

Owing to the presence of water near the surface, the furnaces are built only about 2 ft. 9 in. below the ground level. Each cell has its own recuperator and is separately controlled by a gas, air, and flue damper. All dampers except the gas dampers are operated from the cell working-platform, the gas dampers, which are of firebrick, being worked from the producer charging-platform. Above each cell is a detachable circular cast-iron firebrick-lined cover which can be quickly lifted and swung aside by means of a small hand-operated swing-crane which serves two cells.

The two furnaces are built side by side 6 ft. apart at their nearest points, and are connected to each other by chequer plating both at the cell working-platform and the producer charging-platform levels, thus giving easy access to both furnaces without having to descend to the ground level. A single steel chimney 3 ft. dia. and 55 ft. high situated at the back, serves the two furnaces or four pot holes, and is sufficiently large for another furnace.

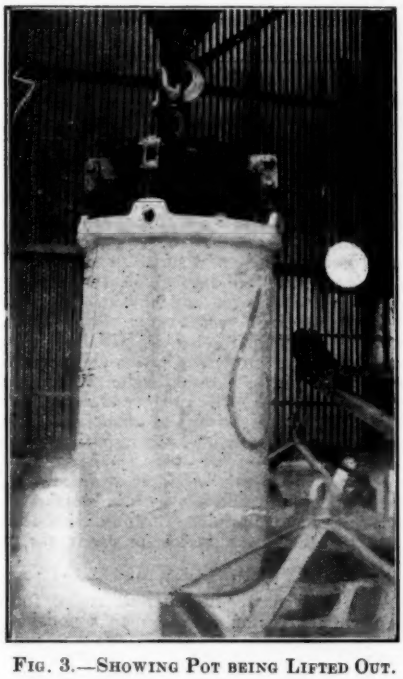


FIG. 3.—SHOWING POT BEING LIFTED OUT.

The producer supplies a good carbon-monoxide gas at about 800 deg. C., which, after passing the gas-control damper, flows into the cell under a slight pressure due to its natural buoyancy. The hot gas enters the cell tangentially through a port placed at the top just under the cell cover. The necessary secondary air (also under its own pressure) enters the furnace cell tangentially at a temperature of 700 deg. C. through a port side by side with the gas port, and the currents of gas and air flow together. Combustion takes place in the annular space between the pot and the cell walls, and the resulting flame descends spirally round the pot and is finally ejected from the cell chamber through a series of holes in the floor. The waste gases then pass at a temperature of 900 deg. C. into the patent recuperator situated below each cell, and after flowing round a series of tubular bricks of special design they are drawn into the chimney at 200 deg. C.

Attention is drawn particularly to the special combustion conditions taking place in the cell. The gas stream flows in contact with the pot, whilst the stream of hot air flows between the gas and the cell wall or lining. By this arrangement, the cutting action of the flame against the cell lining is considerably reduced, and in addition the pots are protected from oxidation even when the furnace is working with a slight excess of air. The ruling temperature in each cell during the test was about 1,000 deg. C., and a slight pressure was constantly maintained therein in order to prevent outside air from leaking in and thus causing excessive oxidation of the pots. The chimney pull was only required to evacuate the waste gases from the recuperator and not from the cell from which the flames were ejected by the pressure in the cell.

The plant includes an electric 5-ton overhead travelling crane, which lifts the pots in and out of the furnace by means of a special four-hook device. Enclosed cooling-pits of concrete are placed adjacent to the furnace, and near by is a special tilting cradle by means of which the pots are tilted and emptied when cool enough. When a pot is ready to be withdrawn, the cell cover is lifted and swung aside by the small hand crane previously mentioned, and the pot is then removed by the overhead crane. The lid is immediately replaced pending the arrival of the next charge, and the air- and flue-dampers are closed down. By this means the heat in the cells and the recuperators is so well conserved that the temperature in the recuperator remains practically constant even when a cold pot is introduced into the cell. The cell temperature, of course, drops slightly but quickly recovers.

A furnace of the same type has just been set to work at the Whitecross Company's Works, Warrington, with satisfactory results, and similar furnaces are in course of erection at the works of Messrs. Richard Johnson and Nephew, Limited, Manchester; Job Wheway and Son, Limited, Birchill's Hame and Chain Works, Walsall; the Firth Company, Limited, Warrington; and Doncaster Wire Company, Doncaster. Many other works are considering the adoption of this type of furnace for various purposes. As a point of interest it might be mentioned that Messrs. Job Wheway and Son, Limited, Birchill's Hame and Chain Works, Walsall, propose to use their furnaces for both chain-annealing and for the annealing of malleable castings, thus proving the adaptability of this type of furnace.

The rotary flame principle is also claimed to be ideal for ingot soaking and tyre heating, etc., and especially for forging. A rotary flame horizontal forging furnace for heating 15-ton ingots has been installed for some years at the works of John Cockerill, Seraing, Belgium, and is said to be working very successfully and economically.

THE WAR WORK OF THE BUREAU OF STANDARDS.—It has seemed advisable to gather together in one report descriptions of the important military investigations conducted by the American Bureau of Standards during the war. This is important for two reasons. In the first place it is essential that as complete a record as possible be kept of the activities of the Bureau during the period of hostilities; and, in the second place, many of the results gained through military investigations are equally applicable and important in peace-time work. A very large number of subjects will be found to be treated, a few of which are as follows: Aeronautic instruments; aeronautic power plants; aircraft materials and construction, such as the relative merits of wood and metals for building airplanes, the best substances for airplane dopes, etc.; balloon gases, including the work which the Bureau performed in connection with the recovery of helium from natural gas; the calibration of testing machines, by which the tests made at various arsenals and munitions plants were referred back to the standards of the Bureau; various chemical investigations, including analyses of ferrous and non-ferrous metals, the development of platinum substitutes, the routine testing of soap, oils, and paints, experiments in connection with the prevention of corrosion, etc. Chromatic camouflage and its detection illustrates the application of scientific work in optics to modern warfare, while the description of the investigation of various processes for coking inferior grades of coal illustrates the successful co-operation of the Bureau with other Government establishments, in this case the Bureau of Mines.

XUM

The Heat-Treatment of Stainless Steel.

By John L. Cox.

In the June 23 issue of The Foundry Trade Journal, a paper which Mr. Elwood Haynes read before the annual meeting of the American Iron and Steel Institute was given in abstract. At the meeting an interesting contribution was made to the discussion by Mr. John L. Cox, assistant superintendent of the Medvale Steel Company of Philadelphia, and is given in a recent issue of the *Iron Trade Review*. Mr. Cox stated that stainless steels are exciting much professional interest throughout the world, but have not yet begun to be employed here in the arts to the same extent as in England. They are typical products of the speciality steel plant, for their successful manufacture requires attention to detail inadmissible in a plant devoted to a tonnage output. Most easily and successfully melted in the electric furnace, the ingots must be reheated and roughed before cooling, or be annealed, otherwise they will crack. With a carbon of 0.70 per cent. or over, American practice is to rough under the hammer or in the mill, at about 1,175 deg. C., but with carbon about 0.35 per cent. the steel works perfectly at 1,230 deg. C.

The roughed material will probably crack if completely air-cooled without being reheated and soaked for awhile at a temperature below but near the Ac_1 point, and, moreover, would be too hard to chip without this treatment, for it is self-hardening. Of the finished rolled bars a large proportion will crack where they touch the hot-bed rails, if cooled in the ordinary way. Before cooling too low they must be reheated, which can be done satisfactorily for the purpose at about 730 deg. C. for 45 minutes, and cooled either quickly or slowly, or they may be charged into heated pipes, and in them annealed in the ordinary manner. Even at a rolling heat the material is unusually rigid, and small sections are hard on the rolls.

On account of the self-hardening character of the steel, the flash of drop forgings and the excess width of roll-drawn knife blades must be trimmed hot; if the section is thin it is advisable even to reheat before trimming, to avoid cracks. When the investigation of alloys of this kind was undertaken a number of years ago the crucible process was employed, and, to secure good surfaces, found it advisable to run both manganese and silicon 1 per cent. or over, but with the electric furnace such figures are not required, and excellent surfaces can be secured with manganese 0.50 per cent. and silicon 0.30 per cent. or below.

Chromium appears to raise the temperature of the carbon change point roughly 7.4 deg. C. for each per cent., at the same time lowering the magnetic or beta iron transformation point, so that with steels containing as much as 13 per cent. of chromium the Ac_2 point may be as far as 111 deg. C. below Ac_1 point. The usual Ac_1 point for these stainless steels with chromium 10 to 25 per cent. and silicon below 1 per cent. is from about 820 to 895 deg. C. Theoretically it is a matter of indifference how fast a piece be cooled from a heating to below its Ac_1 point, and this rule holds with these stainless steels, it generally sufficing to air-cool or quench them from about 730 to 785 deg. C. to produce machinability and a Brinell figure of 275 or less. Greater softness can be obtained by annealing at 895 deg. C. or above, followed necessarily by slow cooling, although it is said that steel so treated takes a poorer grade of machine finish.

Several observers confirm our experiments, showing that, as the hardening temperature is raised above the Ac_1 point, the hardness, tensile strength, and elastic limit of the steel increase, the more resistant becomes the steel to staining, and the more refractory it becomes to subsequent tempering. There is a limit, soonest reached in stainless qualities, heating beyond which gives no resulting gain, and deterioration follows. For physical properties this point is reached at about 1,275 deg. C. according to some authors, although this is from 55 to 110 deg. C. above the results of our experience. A generally satisfactory range for hardening is from 955 deg. to 1,065 deg. C. Quenching may be done in air, oil, or water, depending on form, section, and properties desired. While some authors advocate quenching in water, the author's experience indicates oil as the most generally satisfactory medium.

A Brinell hardness of 669 has been obtained in a section as thin as ¼ in., although the ordinary figures are from 500 to 600 for the fully hardened steel. On tempering pieces of hardened stainless steel it is noticeable that the Brinell hardness diminishes much more slowly than with ordinary steels, and it may even increase from the original figure if any austenite remains from a high quench. Untempered from a high quench, the steels are generally too brittle to be even accurately measured for tensile strength, though it runs in the neighbourhood of 107 tons per sq. in. in a piece ½ in. in diameter.

On reheating a piece quenched from about 925 deg. C. the physical properties generally suffer little change until a temperature of about 425 deg. C. is reached, when there begins a rapid drop in tensile strength and elastic limit, and a corresponding increase in elongation and contraction of area. By different observers this temperature of change is variously given, even for similar compositions as 425 or 480 deg. C., but the lower figure corresponds closely to our own experience over a wide range of compositions. Tempered at about this temperature, a tensile strength of 89 to 102 tons per sq. in., a proportional limit of elasticity of 59 to 75 tons, an elongation in 2 inches of from 10 to 14 per cent. and a contraction of area of from 20 to 28 per cent., can be had in ½-in. round bars with a Brinell hardness of about 460.

From 425 up to about 535 deg. C. the fall in tensile strength and hardness is regular and rapid. At about 535 deg. C. there may result a tensile strength of from 53 to 67 tons per sq. in., a proportional limit of elasticity of from 27 to 53 tons, an elongation of from 14 to 19 per cent. in 2 inches a contraction of area of from 47 to 57 per cent. and a Brinell hardness of about 320.

Up from about 535 deg. C. in tempering temperature, the change in the physical properties is markedly slower and remarkably slow. Thus, the same steel tempered 705 deg. C. still showed tensile strength 52 tons per sq. in., and proportional elastic limit 38 tons, with extension 21.2 per cent., contraction of area 59.1 per cent., and Brinell hardness 241. Had the initial quench been from a higher temperature, a higher tempering temperature would have been necessary to obtain the same final results. It is this property of retaining high hardness at high temperatures, combined with the extraordinary small tendency to oxidation that has made this material so suitable for use in gas engine exhaust valves.

Mr. Haynes has well said that these steels should be freed from rust and adherent scale, for such spots prove centres of corrosion on a polished surface. The character of the surface has much to do with its non-tarnishing properties, for the higher the finish the more resistant to oxidation is the steel and the more resistant to staining by the usual reagents employed. Buffing appears slightly to reduce the resistance to staining. The more fully hardened are these steels, the more they tend to resist oxidation and staining, and it is our experience that the higher carbons, with the necessarily increased chromium content, tend to resist oxidation rather better than the lower carbons.

Licences under the Non-Ferrous Metal Industry Act, 1918, have been granted to Mr. T. Appleby, trading as Appleby & Company, 26, Examiner Buildings, Strutt Street, Manchester; F. Brownsmith & Company, 14, New Street, Birmingham; Davis Motley & Company, Limited, 82, Victoria Street, London, S.W.1; and Vitoria y Galbete, Florencio, trading as Vitoria Galbete & Company, 32, Fenchurch Street, E.C.3.

Terms and conditions for a reduction in wages have now been accepted by the Amalgamated Engineers' Union on behalf of the Bristol Channel dry dock and engineering undertakings, with the result that as from Monday, August 1, wages have been reduced 4s. per week. A further reduction of 3s. per week operates in October. The question of the 12½ per cent. reduction is deferred until trade conditions warrant a further investigation.

XUM

Foundry Pits.

By J. GERRARD.

Many castings, such as a bedplate for the larger types of horizontal gas-engine castings weighing about 20 tons, are preferably made in up-to-date foundries by sinking of pits large enough to contain the heaviest castings likely to be handled

These pits are sometimes made by building a substantial wall constituting a lining, or by cast-iron plates bolted together in such a manner as will form an enclosure which is capable of withstanding a great amount of pressure without danger.

If pits are made of any great depth it is necessary that some system of drainage should be incorporated. Various methods may be adopted to accomplish this, one by the use of pumps and another by the use of compressed air, with which all foundries should be supplied.

It is also necessary that the bottoms of foundry pits should be so designed that anything which has to be made can be bolted down in a thoroughly sound manner in preference to the old-fashioned methods of using weights.

It has always to be borne in mind that every precaution must be taken to provide against accidents, and in the making of a large casting it is necessary that a good foundation be made.

For the drainage of the pit a good substantial layer of rubble or other material through which the water can percolate should be laid in the bottom of the pit in such a manner that all water which may accumulate will run to one corner, or wherever it is most convenient according to the lay-out of the foundry.

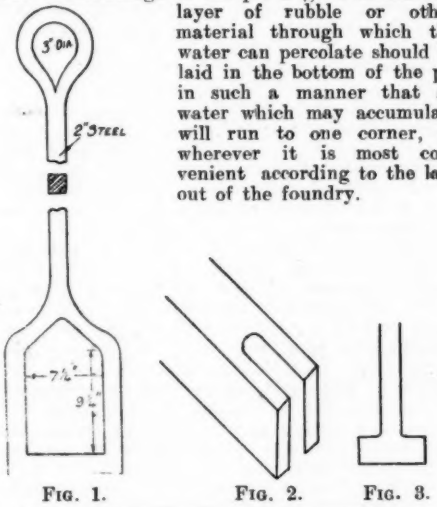


FIG. 1. FIG. 2. FIG. 3.

FIG. 1.—UPRIGHT FOR USE WITH THE BINDER SHOWN IN FIG. 4. FIGS. 2 AND 3 SHOW AN ALTERNATIVE METHOD.

This can easily be accomplished by laying the rubble in a small trench which should be prepared the whole of the way round the pit bottom and connected across the centre in the manner indicated in Fig. 5, which shows the pit in broken section and plan.

After filling in the trench it is advisable to cover the bricks around the lowest point (A. in Fig. 5) with pieces of cast-iron plate, which will prevent the sand from reaching the pump at this point, then cover the whole of the pit bottom with the ordinary floor sand about three inches above the bricks.

Above this layer of sand the binders which are used for bolting down purposes must be laid.

These binders can be made of cast-iron, which, if expense has to be considered, can be cast open-sand, but, as not only the soundness and general success of the casting depends on these, and also the lives of workmen, it is essential that they be as perfect as possible, hence it is preferable that they should be covered.

Fig. 4 shows the type of binder to be used on the bottom of the pit.

The chief reason for using a binder with the strengthening rib of this character along the centre is that the centre of the binder is actually the weakest spot, consequently it should here be given extra strength. The central rib is the most adequate method for accomplishing this.

The 2 in. dia. holes are cast-in, simply as a means for handling until it is finally placed in position. For a pit of the dimensions shown it would be necessary to place six of these binders side by side and equidistant, starting with the two end ones, which are placed about 2 ft. from each end of the pit.

The binders are placed so that the plain side is uppermost and set parallel and as level as possible. They can readily be set level by laying them on cast-iron blocks, one at each end, just

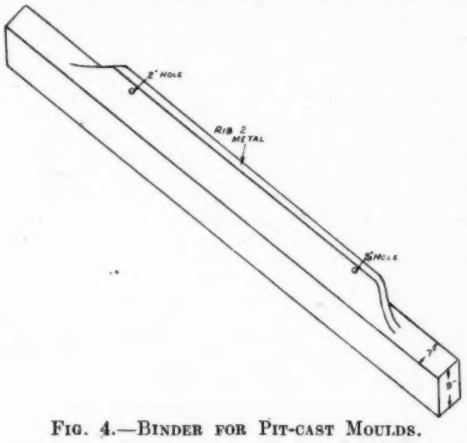


FIG. 4.—BINDER FOR PIT-CAST MOULDS.

clearing the centre rib. Around each end of the binders mild steel uprights are fastened which will be of sufficient length to reach to within three inches of the foundry floor-level.

Many kinds of uprights are used for this purpose, but preference should be given to the type shown in Fig. 1, which is made of 2 in. sq. material. These should be placed in position one over each end of the binder, about 3 in. from the extreme end. It is advisable to paint the bottoms of these uprights with a good coating of tar to prevent corrosion. This type of upright is very reliable, as there is small chance of them turning round and coming off the jaw of the binder. A method of

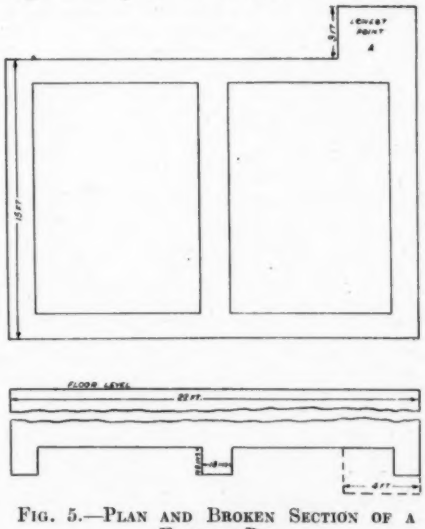


FIG. 5.—PLAN AND BROKEN SECTION OF A FOUNDRY-PIT.

making binders with a slot in the jaw is sometimes adopted, and is shown in Fig. 2, and in Fig. 3 the type of upright used with such a slot jaw binder is shown.

This type of construction is not to be recommended on account of the possibility of the upright turning round when being screwed up.

The binders having been placed in position the next operation is to ram up to the level of the tops of the binders on which cast-iron plates are placed for the purpose of covering the whole of the pit bottom; these plates should be made as

XUM

large as possible in order to avoid the possibility of pulling them out of position when finally bolting down. If anything of this nature should happen, it cannot be seen; hence the necessity for caution.

Inside the lowest point in the corner of the pit, shown at A, Fig. 5, and immediately above the bricks, a pipe, preferably a drain pipe, at least 18 in., should be placed and carried upwards until it reaches the floor-level.

From this point there is free access to any water which may accumulate, and which can be removed by any usual method.

The adoption of the method indicated assures the mould being made as securely as possible, and practically eliminating all risk.

Assuming that the top part has been placed in position and the mould finally closed, another set of binders similar to those laid in the pit bottom, with the exception, that for the top, but the type shown in Fig. 2 is used.

Hook bolts must now be inserted in the eyes of the uprights as shown in Fig. 3, the screwed ends of which should stand through the slot in the jaw of the top binder, leaving just sufficient room to enable a washer or two to be added, and at least a fall nut when finally screwing up.

The jaws should be made about 2½ in. wide, which will give sufficient play for a 2-in. bolt.

These bolts should be taken care of and kept solely for this purpose.

Obviously when the top binders are laid across the top part and screwed up tightly to the uprights, it is impossible for this mould to lift from its position under ordinary conditions.

An Oil-Fired Annealing Furnace.*

By William F. Hoernke.

Coal has been generally used for annealing malleable cast iron since the industry began. Other fuels also have been tried, and it is reported that as much as 30 years ago one firm experimented with oil. A company in the United States has been using oil continuously for over ten years. But in spite of an attempt here and there, coal as a fuel for annealing has not been displaced to any great extent. However, about four years ago, due to an increased knowledge of how to use liquid fuel, to the development of better apparatus for applying it, and to the difficulty of securing coal on account of war conditions, several firms tried oil, and some of them continued to use it. The handicaps which prevented more general use of oil were undoubtedly the cost, its uncertain supply, and the expense of the tanks and equipment required. Also, many companies had neither compressed air nor steam, one of which would be necessary to atomise any liquid fuel.

The Stowell Company, Milwaukee, was in a good position to experiment with oil as an annealing fuel, because it possessed an oil tank of 10,000 gallons capacity and had been burning oil for some time on its core ovens. In changing from coal to oil, the firebox of the annealing ovens was altered. It was not an expensive change, and was made by two men in a few hours. The gratebars were left in. The firebox area was 9 ft. in length by 2 ft. in width. The gratebars were first covered with two courses of firebrick. An opening 4 in. wide, and extending about half the length of the firebox, was left at each side to furnish draft. Starting about half-way from the front end of the firebox, where the burner is placed, additional courses of brick were stepped to form a baffle for the flame. This baffle is about 2 ft. high at the back end of the firebox. Silica sand to a depth of 2 in. was then put on the baffle to protect the brick.

The firedoor was bricked up, leaving an opening 4 in. square on the outside, flared to 8 in. square on the inside. This forms a combustion chamber, which gets red hot and keeps the flame lighted in case the oil supply or pressure is not steady. The opening is 2 in. above the brick floor of the firebox. The ashpit door was loosely bricked up, and the draft is controlled by adding or removing a brick. The burner is mounted in the centre of the 4-in. opening, and in line with the outside wall.

The oil line from the oil-supply tank passes through a small tank fitted with a strainer and heating coils. The oil is pumped at a pressure of about 25 lbs. The line is supplied with a meter and the necessary valves. Either steam or air can be used to atomise the fuel oil. Steam is used at one of the plants of the Stowell Company, and air is employed at the other. Steam is under a pressure of 80 lbs. per square inch, and air at a pressure of 60 lbs. If the steam at the oven is not dry, it is necessary to put a water trap just before the burner. The reason steam is used at one plant is that the compressed air supply is inadequate.

At first the ovens were equipped with two burners to an oven, but it was found that one burner of the half-inch size was enough. The burners were furnished by W. N. Best, Inc., New York.

To start the burner, it is first heated with a flame from some waste wetted with kerosene, before any valves are opened. Next, the atomiser valve is opened slightly. This blows the flame from the burning waste into the combustion chamber. Then the valve on the oil line is opened fully and the oil is carefully turned on by means of the oil-regulating cock.

Some experience is needed to get the right mixture of oil and air, and, as this is acquired, a saving in the amount of oil required will be noticed. There should never be more than a faint smoke coming from the top of the stack. If no smoke comes from the stack, too much air is probably being used, which tends to cool the oven. A heavy smoke indicates too much oil in proportion to the air supplied, giving incomplete combustion.

When the oven reaches the annealing temperature the flame can be cut down by turning off the oil and the air or steam. For the two hours after the burner is started the damper is left wide open, then it is closed half way, and left at this point until a temperature of 870 degs. C. is reached. It is then closed to a 2-in. opening.

Pyrometers are placed in the front and back of the oven, about 4 ft. from the floor. If either pyrometer shows a higher temperature than the other, the irregularity of temperature can be corrected by tilting the burner slightly up or down.

Ovens have been brought to temperature in 18 hours, but this practice is not recommended. The average time for bringing an oven to temperature is about 30 hours. The ovens are held from 70 to 75 hours, counting time when the temperature reaches 815 degs. C. The burner is then shut off, first turning off the oil and then the steam or air, after which the burner is tilted up away from the opening, which is luted up. The opening below the grates is similarly closed, and the draft damper is tightly shut. The oven remains in this condition until it reaches a temperature of 535 degs. The average rate of cooling is a little less than 4 degs. per hour.

The use of oil as a fuel has many advantages which must in some instances make up for the higher cost of the fuel, or no one would continue to use it. One advantage is the saving of labour. Formerly a fireman and an engineer were employed, and part of a labourer's time was required to wheel ashes and coal on the day shift, and one man's full time was needed at night. One man is now used as fireman and engineer, and the labourer on the day shift has been dispensed with. Also the night man is able to do extra work that does not take him away from the ovens for long at a time. A saving in the annealing pots is effected. The amount of this saving may be estimated by the fact that three or four wheelbarrow loads of scale were taken from every oven after an anneal when coal was used, whereas now less than one wheelbarrow load of scale is taken from an oven. The grates, which were previously used, are not required. When coal was used the flues had to be cleaned about every six months. The ovens now are operated for from 18 months to two years before it is necessary to clean the flues. Should it at any time be impossible to secure oil, it would take only a short time to equip for burning coal. Considering everything, the Stowell Company feels the choice of oil as a fuel for annealing has been justified, and from an operating standpoint would not willingly change back to coal burning

*Paper read at a recent meeting of the Milwaukee Malleable Club by William F. Hoernke, foundry superintendent, the Stowell Company, Milwaukee.

Trade Talk.

ONE of the mills at Workington belonging to the United Steel Companies, Limited, was restarted last week.

STEELWORKERS at Dowlais have affirmed their executive's recommendation to accept £4 10s. weekly till September, and £4 5s. after that till December.

SIR P. LLOYD GREAME told Mr. Gilbert in the House of Commons, on Monday, that it was the intention to hold a British Trade Exhibition at the White City next year.

THE FIRST blast furnace to be relighted on the North-West Coast of England was put into draught at Cleatormoor, Cumberland, by the Whitehaven Hematite Iron and Steel Company on August 8.

WORK HAS NOW BEEN commenced on the new copper mine at Sandlodge, near Lerwick, Shetland Islands, in connection with which a company was recently floated in Aberdeen.

SHIPS BUILT IN UNITED STATES, and officially numbered by the Bureau of Navigation in the year ended June 30, totalled 1,429, of 2,210,221 gross tons. In addition 33 vessels of 66,038 gross tons were built for foreign owners.

A BOARD OF ARBITRATION has been set up in connection with a dispute between the Shipbuilding Employers' Federation and the various shipbuilding trade unions covering riveters, platers, shipwrights, and blacksmiths.

THE AMALGAMATED ENGINEERS' UNION has accepted the terms and conditions for a reduction in wages. The decision affects the whole of the Bristol Channel dry dock industries, and has no connection with the steel workers' dispute.

THE CLYDE shipbuilding output for July was 13 vessels, aggregating 29,313 tons, compared with 40,476 in June. The big shipbuilding yards in the upper reaches of the river were closed for three weeks. The output is regarded as satisfactory.

THE MINISTER OF TRANSPORT has confirmed the Dearne District Light Railways (Amendment) Order, 1921, authorising the construction of light railways in the urban district of Wath-upon-Dearne and of Bolton-upon-Dearne, in the West Riding of Yorkshire.

MESSRS. WORKMAN, CLARK & COMPANY have launched from their South Yard, Belfast, the s.s. "San Benito" for the Unifruites Steamship Company, Limited. The vessel, which is 325 ft. long with a gross tonnage of 3,650 is intended for the Central American fruit trade.

THE HYDRO-ELECTRIC plants in Italy at the end of 1920 numbered 387, with a total capacity of 1,152,131 h.p., while in 1915 they numbered only 329, with a capacity of 935,009 h.p. The plants in course of construction number 54 with a potentiality of 359,213 h.p.

THE ESTIMATE of money required for the Ordnance Factories in 1921-22, states White Paper No. 196, is £350,000 (£100,000 for Royal Ordnance Factories, and £250,000 for national factories), the expenditure being estimated at £7,580,775, and the appropriations in aid £7,230,775.

THE DECISION that the war shall be formally ended in September raises a question of great interest for all engineering workers, because it suggests the automatic abolition of the famous 12½ per cent. bonus, which figured prominently in the recent threatened lock-out dispute.

THE BI-MONTHLY examination of the employers' books under the Scottish Manufactured Iron Trade conciliation and arbitration agreement, brings out the average net selling price of malleable iron at £19 12s. per ton, which entails a further reduction of 2½ per cent. on workmen's wages.

THE TENDER of a Swiss firm, Messrs. Brown and Boveri, is reported to have been accepted by the London County Council for an 8,000-kilowatt turbine for Greenwich power station. The contract is worth £45,000 and is £6,000 or £7,000 lower than the quotations of competing British firms.

NO SETTLEMENT was reached at a joint meeting of the Welsh Founders and Engineers' Board, held at Swansea, under the presidency of Mr. F. Taylor. It was held to consider a demand for a further reduction of wages, representing 15s. for skilled and 11s. 3d. for unskilled men, making a total of 25s. and 16s. 3d. respectively.

ARRANGEMENTS, it is reported from Adelaide, have been made for a resumption of work at the Port Pirie Smelting Works, which since the great fire six months ago have been closed down, nearly 600 men being rendered idle. By agreement entered into, the employés will accept lower pay in preference to the alternative of longer hours.

A WELL-KNOWN engineering firm, Messrs. Markham & Company, Chesterfield, proposes to decrease costs of production at the old rates of pay by increasing the number of working hours per week. The scheme is to extend the working week from 44 hours to 47 hours by the addition of a half-hour at the beginning of each working day.

AN order for 16 locomotive boilers, required by the Madras and Southern Mahratta Railway, is reported to have been placed with Messrs. Clayton & Shuttleworth, Limited, Lincoln, whilst Clayton Wagons, Limited, have also received orders from Shell-Mex, Limited, and the British Petroleum Company, Limited, for 100 oil tank wagons, each 14 tons carrying capacity.

AT THE Trades Union Congress, to be held at Cardiff next month, a resolution from the Iron and Steel Trades' Confederation will be moved, drawing attention to the present policy in regard to the conduct of industrial disputes, and calling for the provision of a proper opportunity for consideration of the merits of a dispute before a stoppage of work on a large scale takes place.

LICENCES under the Non-Ferrous Metal Industry Act, 1918, have been granted to Mr. T. Appleby, trading as Appleby & Company, 26, Examiner Buildings, Strutt Street, Manchester; F. Brownsmith & Company, 14, New Street, Birmingham; Davis Motley & Company, Limited, 82, Victoria Street, London, S.W.1; and Vitoria y Galbete, Florencio, trading as Vitoria Galbete & Company, 32, Fenchurch Street, E.C.3.

THE FIRST MEETING of the Board of Arbitration which has been set up under the Industrial Courts Act was held in Glasgow on August 9, when a commencement was made with the hearing of proposals of the Shipbuilding Employers' Federation for the withdrawal of the standard ship cycle of advances and the consequential increases in wages given during the war period. Nearly all branches of shipyard workers are concerned in the arbitration.

ALL CONCENTRATES delivered to the Government to date by the Zinc Producers' Association had been paid for, Sir W. Mitchell-Thomson stated, in reply to a question in the Commons. There were at present no inquiries for the purchase of the concentrates at prices which he was prepared to accept, but it was hoped that a sale might be effected shortly of concentrates in Australia for smelting there. There was, however, a continuing contract in regard to future production.

THE QUESTION of adjustment of contract prices to meet increases of wages under awards authorised by industrial courts is of considerable importance to firms who have had contracts with Government Departments since the passing of the Industrial Courts Act, 1919, and is now attracting the attention of traders. In some cases the awards have not been admitted by the Department concerned, and the Federation of British Industries is taking the matter up with the proper authorities.

THE RAILWAY RATES ADVISORY COMMITTEE met again under the chairmanship of Sir F. Gore-Browne, K.C., on July 28. On the question of privately-owned rolling-stock, counsel for private wagon owners asked the Committee to recommend that an empty wagon diverted from its route to or from the works on a free journey, for the purpose of repairs, shall be deemed to be on one continuous service and not subject to any charge. The chairman indicated that the Committee would be glad to see the railway companies adopt it.

STRIKING evidence of the depressed state of the shipbuilding industry is afforded by the fact that during the month of July not a single vessel was launched from the Wear yards. Whilst it is hoped that, as material comes to hand following the starting of the blast furnaces, more employment will be provided, local shipbuilders are not at all optimistic of a speedy return to anything like ordinary conditions. The joiners' strike is holding up much work also, and present conditions indicate that the shipbuilding depressions of 1907-8 and 1887 have to be looked up to find a state of affairs so serious.

AT AN ADJOURNED conference, held at Sheffield last week, between the Crucible Steel Makers' Association and the Sheffield and District Engineering Trades Employers' Association and the Iron and Steel Trades' Confederation, the business before the conference was the consideration of the application of the employers for a reversion to the three-round day, and a reduction in wages of 17½ per cent. Between 70 and 80 firms, millers of crucible steel, are affected. At the conclusion of the conference terms were agreed upon for the adoption of the proposed scheme, subject to some modification, the agreement coming into operation on August 2.

CIE. CONTINENTALE DES FOYERS TURBINE (SOC. AN.), 29, Rue de l'Evoque, Bruxelles, was recently formed, with a capital of one million francs, to exploit the turbine furnaces. Mr. W. H. Badams, the managing director of the Turbine Furnace Company, Limited, of 238B, Gray's Inn Road, W.C.1, has a seat on the board of the Continental company, as representing the English interests. The managing director of the Continental company is Lieut.-Colonel B. A. Thornton, and the board includes, amongst others, Compte Louis van der Burch, Compte de Pellan, and Mons. D. Rom, representing the interests of Compte Horace van der Burch—one of the principal shareholders.

XUM

IRON AND STEEL MARKETS.

Pig-iron.

Movements in pig-iron were, of course, entirely suspended last week from holiday causes, and since there has been little attempt to open up business by either consumers or producers. That both parties are justified in an attitude of caution can be readily understood in the existing conditions, neither buyers nor sellers being disposed to undertake fresh commitments while the fuel price problem remains unsolved. It is, at all events, generally recognised that no active resumption of pig-iron production is feasible while the uncertainty on this important point remains, although signs are not wanting that, having regard to economies effected in other directions, it may be possible to resume furnace operations at an earlier date than has been anticipated. In the West of Scotland the pig-iron market remains inactive, and most of the furnaces are idle. An exception to the rule is, however, supplied in the case of one maker, who, it is asserted, has already sold iron for delivery in September. There has been a slight improvement in export inquiry, but the prices now ruling at Glasgow are not favourable to expansion in this direction. Quotations on the Cleveland pig-iron market may be regarded at present as in a transitional stage, dependent almost wholly on the existing scarcity. At the moment No. 3 G.M.B. is purchasable for immediate delivery at 135s. per ton, with an additional 5s. per ton for export. As much as 140s. per ton and 145s. respectively is, however, being demanded for early forward dates, though these figures are probably more or less nominal, and could be improved upon against firm offers. No. 4 foundry is scheduled at the same price as No. 3. The lower grades are still a drug in the market notwithstanding their relative cheapness, and the prices are unchanged at 117s. 6d. for No. 4 forge and mottled, and 115s. for white. In the meantime business is necessarily restricted to small prompt sales of such descriptions of foundry iron as are still available in the steadily diminishing stocks. The demand, however, is very quiet. Home consumers generally are not busy and can afford to follow a waiting policy, until such time as there is a decline from present high values. There are as yet no indications of the blast furnaces in the Midland area being restarted. It is stated that coke is offered at about 40s. to 41s. delivered, though there seem to be no fixed quotations. Low quotations are heard of for Belgian No. 3 iron, one being down to £5 10s. This, probably, is an isolated case, but it is easily procurable at well under £6.

Business in hematite recovers but slowly Stocks are low, but buyers are easy, and are disposed to proceed with great caution, with mixed numbers still at 160s. per ton. A reduction of 20s. per ton for the foreign markets appears, however, to have had but little effect on export business, being still above the figure at which buyers abroad would be prepared to trade.

Scrap.

Business in scrap material remains virtually a dead-letter, buyers holding off the market, and although there is some anticipation of a revival of demand to a limited extent on behalf of the foundry trade, no movement in that direction has yet been initiated. In the Midlands a few transactions are reported for wrought iron, as one or two firms have commenced consuming, but the prices offered are intrinsically very low. Cast-iron scrap remains very firm, but, of course, the vast majority of foundries were closed last week, and very few parcels have changed hands. At Middlesbrough the scrap trade is still stagnant, the works for the most part keeping out of the market. Prices are still more or less nominal round about the following figures: Heavy steel scrap, £3; heavy cast-iron scrap, £5 15s.; heavy wrought-iron scrap, £3; steel turnings and cast-iron borings, £2 to £2 5s.; all delivered works.

Steel.

Movements in most sections of the steel industry so far show few signs of renewed activity, and in some branches work has not yet been resumed after the holidays. Reports from overseas markets are by no means encouraging, although business is said to be slightly improving in the Near East, but the unsettled condition of European exchanges and financial difficulties in commercial centres abroad are a heavy handicap to an early re-opening of our export trade in steel products. In Sheffield, the decision of the Admiralty to build four new capital warships has been received with general satisfaction, as it must eventually provide much-needed work for the principal armament and engineering firms in the district, although the prospect involves little hope of an early commencement of any contracts which may be placed with local producers in these branches of industry. Operations in the crucible steel departments continue restricted to a few orders in hand, the contracts now placed in these lines being only on a limited scale. Manufacturers of railway steel are also greatly disappointed with the long delay in securing contracts, which, in the opinion of the majority of makers, are being withheld until the anticipated reductions in prices have definitely materialised. Home railways are evidently influenced by this policy, as it is indisputable that a vast amount of rolling stock and permanent way requirements are urgently needed to replenish the wastage of the protracted war period. In this section also Continental producers are keenly competing for orders with British manufacturers, the high prices charged by Sheffield makers for tyres, springs and axles having induced South American and Indian customers to place their orders with German and Belgian makers. Among minor articles of Sheffield production the demand for files may be regarded as fairly satisfactory, but most makers, having heavy stocks, are supplying from that source for the present. In the West of Scotland conditions are gradually improving in the mill sections of the steel works. Orders, however, are not sufficient to justify the full resumption at works. The hold-up of vessels in the fitting-out stage is leading to serious congestion and the slowing down of work on vessels in stocks. Steel makers on the North Coast find new business very quiet and works generally are compulsorily restricting operations. There has been no change in steel values since the holidays, but quotations are in most instances of a nominal character only, pending a solution of the fuel prices question.

Finished Iron.

Extended holidays having been the rule in the finished iron trade, there has been little attempt at business in the Midland market, and in manufacturing circles the impression is generally held that no revival of active buying is at all likely until after the end of the current quarter. It is, however, reassuring to learn that a further stage in the reduction of production costs has just been reached, by the announcement of an 80 per cent. drop in iron workers' wages under the sliding scale of the Midland Iron and Steel Wages Board, taking effect this week. A reduction was anticipated and has already been discounted by reduced selling prices, but the amount of it, following upon a 35 per cent. reduction as a result of the March-April ascertainment, came as a surprise. It affords evidence of the pace at which deflation is proceeding. The total drop since the beginning of the year is 142½ per cent., and the puddling rate now stands at 13s. 6d. plus 122½ per cent. This week there has been a resumption of work at the rolling mills, makers of marked bars having a fair amount of orders on hand, for which prices are firmly maintained at the official figure of £20, net f.o.t. at maker's works. Demand for the commoner qualities is still quiet and business very slow. In Lancashire those ironfounders who have secured a supply of foreign pig-iron at about £6 per ton, delivered, are in a much better position, but it must be understood that the whole ironfoundry business of the district is not what it was a year ago.

Metals.

Copper.—There has been little animation in the standard copper market of late, and this week's opening has been no exception to the rule, business having been limited in scope and without any outstanding feature of interest. There are indications on every hand that recovery from recent labour disturbances will be a very tedious process, and until a revival of general industrial activity occurs, there is little prospect of improvement. Notwithstanding these conditions, markets have preserved a steady tone both for cash and forward dates, Monday's transactions in standard metals, including sales for August, at £70 2s. 6d.; October, £70 7s. 6d.; and November, £70 10s. Electrolytic and wire bars closed at £74 to £75 10s. Closing prices:—Cash, Wednesday, £70 2s. 6d.; Thursday, £70 2s. 6d.; Friday, £70 5s.; Monday, £70; Tuesday, £70. Three Months.—Wednesday, £70 10s.; Thursday, £70 10s.; Friday, £70 12s. 6d.; Monday, £70 7s. 6d.; Tuesday, £70 7s. 6d.

Tin.—The week's markets opened with a more active tendency than has recently been experienced, consequent on a better consumptive demand, and a revival of influential support lacking for some time past. Week-end advices from the East reported sales of 100 tons at £165, c.i.f., and subsequently the market here responded, the buying throughout being good, while values were influenced to further strength by active support from Dutch interests. The statistics for July show an increase in the visible supply of 2,759 tons, and although this cannot be regarded as a very favourable feature, it had little impression on the market. Monday's sales amounted to 525 tons, comprising August at £160 10s. to £161 10s., closing at £160 15s.; September, £161 10s. to £162 15s., and October, £161 10s. to £162. English ingots closed nominally 40s. higher at £160. The weekly return of tin stocks in London

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warehouses at 4,114 tons shows a decrease of two tons; Liverpool stocks at 1,956 tons, an increase of 11 tons with the Swansea stock unchanged at 35 tons. Closing prices:—Cash: Wednesday, £157 10s.; Thursday, £158; Friday, £159 5s.; Monday, £161 10s.; Tuesday, £162 10s. Three Months: Wednesday, £159 15s.; Thursday, £160; Friday, £161 5s.; Monday, £163 10s.; Tuesday, £164 10s.

Spelter.—This metal has been a quiet market for some little time past, but this week has been more sparingly offered, with the result that values have firmed up to a fractional extent. There were August sellers at £25 17s. 6d.; September, £26 5s.; and October, £26 10s. Closing prices, ordinary brands: Wednesday, £25 5s.; Thursday, £25 10s.; Friday, £25 15s.; Monday, £26; Tuesday, £25 17s. 6d.

Lead.—Offers were more liberal this week and values declined, the market closing with soft foreign lead near dates lower by 5s., and forward by 2s. 6d. English qualities also registered a decline of 5s. English closing prices:—Wednesday, £25; Thursday, £25; Friday, £25 5s.; Monday, £25; Tuesday, £25.

Tinplates.

Although several of the South Wales mills are again in operation, production for the time being is almost entirely confined to stock plates, markets remaining quiet in the extreme, with export transactions at a minimum. For delivery over the last quarter of the year the price for cokes seems to be about 24s. basis, net, f.o.b. Wales; it is reported, however, that this figure has been shaded for suitable specifications. Stock plates are in fair demand, and are realising round 27s. basis. Wasters are also wanted in 28 x 20 and 14 x 20, and are realising 20s. basis and upwards; 14 x 18¾, however, are worth no more than 16s. 3d. to 16s. 6d. Terne plates rule easy at 23s. basis for September-October.

Company News.

Smith's Dock Company, Limited.—Interim ordinary dividend, 5 per cent., free of tax.

Walter Scott, Limited.—Final dividend, 1s. per share, making 7½ per cent. for year.

Western Wagon and Property Company, Limited.—Interim dividend, 10 per cent. per annum.

Bristol & South Wales Railway Wagon Company, Limited.—Interim dividend, 5 per cent. actual.

The Mint, Birmingham, Limited.—Interim preference dividend, 6 per cent. per annum, less tax.

Yorkshire Railway Wagon Company, Limited.—Interim dividend, 10 per cent. per annum, free of tax.

Acme Engineering Company (London), Limited.—Capital £15,000 in £1 shares. Registered office: 9, Great Sutton Street, E.C.

Henry Bessemer & Company, Limited.—Interim dividends on preference and ordinary shares passed in consequence of depressed state of trade.

Steam Plant Accessories, Limited.—Capital £5,000 in £1 shares (3,000 8 per cent. cum. partg. pref.) Secretary, P. A. Chester. Registered office: 38, Victoria Street, S.W.1.

Briggs & Company (Engineers), Limited.—Capital £3,000. Directors: G. D. Glasscoe (permanent), and H. V. Glasscoe. Registered office: 5, Lambeth Hill, Queen Victoria Street, E.C.4.

Carlton Engineering & Trading Company, Limited.—Capital £5,000 in 4,000 preference shares of £1 and 20,000 ordinary of 1s. Registered office: Carlton House, Regent Street, S.W.

Crossley, Jacob & Gee, Limited.—Capital £20,000 in £1 shares (10,000 10 per cent. cumulative preference), to carry on the business of engineers. Registered office: 130, Tooley Street, S.E.

Vickers, Limited.—Dividends, 2½ per cent. for half-year on preferred 5 per cent. stock, 5 per cent. preference shares, and cumulative preference shares, the first two less tax and the other free of tax; ordinary dividend passed. Outstanding questions with Government departments prevent presentation of final accounts for 1920.

Ebbw Vale Steel, Iron & Coal Company, Limited.—Profit, £633,247; brought forward, £16,301; available, £649,549; general and legal expenses, £15,827; interest on debentures and loans, £181,743; expenditure on new work, £36,298; final preference dividend, making 7 per cent. for year; reserve, £50,000; reserve for depreciation on stock values, £150,000; ordinary dividend, 5 per cent. for year; carry forward, £6,690.

Braithwaite & Company, Engineers, Limited.—Capital £350,000 in £1 shares, to act as agents in India, Ceylon, Burmah and Siam for Dorman, Long & Company, Limited. The first 80,000 shares are offered to Dorman, Long & Company, Limited. Directors: Sir Arthur J. Dorman (chairman), J. H. Humphryes (managing director), Colonel F. Byrne, L. Ennis, J. C. Telford, and W. A. Radice. Registered office: 117, Victoria Street, Westminster.

Personal.

MR. WILLIAM HENRY BOWKER, late of The Grange, Goostrey, Cheshire, iron and steel merchant, left £16,271.

SIR GEORGE HADCOCK, K.B.E. (a director of Messrs. Sir W. G. Armstrong, Whitworth & Company, Limited), has joined the board of the Still Engine Company, Limited.

THE LATE MR. HENRY BATH, of The Cottage, Lynmouth, Devon, and 53, New Broad Street, E.C., metal merchant, has left property of the value of £24,062 12s. 10d., of which £16,388 0s. 1d. is net personalty.

MR. R. B. MCCOLL, who recently relinquished the position of general manager of the Scotswood Locomotive Works of Sir W. G. Armstrong, Whitworth & Company, Limited, has presented a silver cup for competition amongst the employés at the annual sports.

COLONEL R. SAXTON WHITE, J.P., who has retired from the position of local director of Sir W. G. Armstrong, Whitworth & Company, Limited, and general manager of the Walker Shipyard, was the guest at a complimentary dinner at Newcastle on August 1. Mr. Summers Hunter, managing director of the North-Eastern Marine Engineering Company, Limited, presided.

AN INTERESTING FUNCTION was held at Swansea on August 1, when the managers of the South Wales branch of Baldwins, Limited, met to commemorate the election of Captain H. L. Davies to the board of directors. Captain Davies was the guest at a complimentary dinner, and was the recipient of a handsome presentation. The chairman for the evening was Mr. T. Crosby, general manager of the Margam and Port Talbot Steel Works.

Gazette.

MESSRS. L. GOLDSTON and A. BERIRO, metal merchants, Royal Bank Buildings, 5, Bishopsgate, London, E.C., trading under the style of Beriro and Goldston, have dissolved partnership.

PATRICK ENGINEERING COMPANY, LIMITED (late Oxygen Welding Works, Limited), Birmingham, in liquidation. Mr. C. H. Smith, 84, Colmore Row, Birmingham, was appointed receiver, July 12.

MIDLAND PATTERN MAKING COMPANY, LIMITED.—It has been resolved: That the company be wound up voluntarily. Mr. E. H. B. Butler, Foregate Street, Worcester, I.A., has been appointed liquidator.

TRADING as Bennett Brothers, Messrs. S. J. Butler, H. Usher, and H. F. Culpin, 5, Devonshire Street and 5, Theobald's Road, London, sheet metal merchants, have dissolved partnership. Debts by S. J. Butler and H. Usher, who continue the business.

MAPLESTONE CANTILEVER SPRING FORKS, LIMITED.—It has been resolved: That the company be and is hereby placed in voluntary liquidation. Mr. C. H. Smith, Phœnix Chambers, Colmore Row, Birmingham, has been appointed liquidator. Claims to liquidator by August 26.

TRADING as the Heath Electrical and Mechanical Engineering Company, Messrs. L. Massimo, S. C. Crocker, and E. W. Bartlett, 1, Pembroke Terrace, Cardiff, electrical and mechanical engineers, have dissolved partnership. Debts by S. C. Crocker and E. W. Bartlett, who continue the business.

The Court of Appeal, consisting of the Master of the Rolls, Lord Justice Warrington and Lord Justice Younger, on July 29, handed down a decision unanimously in favour of the Sullivan Machinery Company, with costs, in the patent litigation brought against them by the British Spiro Turbines, Limited.

THE PARTNERSHIP heretofore subsisting between Messrs. J. Hickey, A. Curry, H. Hanson and J. Fletcher, ironfounders, Theaker Lane, Armley, Leeds, under the style of the Theaker Lane Foundry Company, has been dissolved. The business will be continued by Messrs. H. Hanson and J. Fletcher.

MR. THOMAS WILLIAM AITKEN, carrying on business as an ironfounder at 20A, North Street, Luton, came up for public examination in the Bankruptcy Court in that town on July 28. The statement of accounts disclosed liabilities estimated by the debtor at £5,176, with assets in the form of interest in patents calculated to show a surplus of £9,887 17s. 6d. After a lengthy examination the hearing was adjourned to October 6.

THE SHEFFIELD CHAMBER OF COMMERCE have passed a resolution appealing to the local authority to reduce expenditure "in view of the unprecedented trade depression and the fact that many of the largest manufacturing concerns—the principal contributors to the revenue of the city—are employed to the extent of only one-third of their normal capacity with no immediate prospect of improvement."